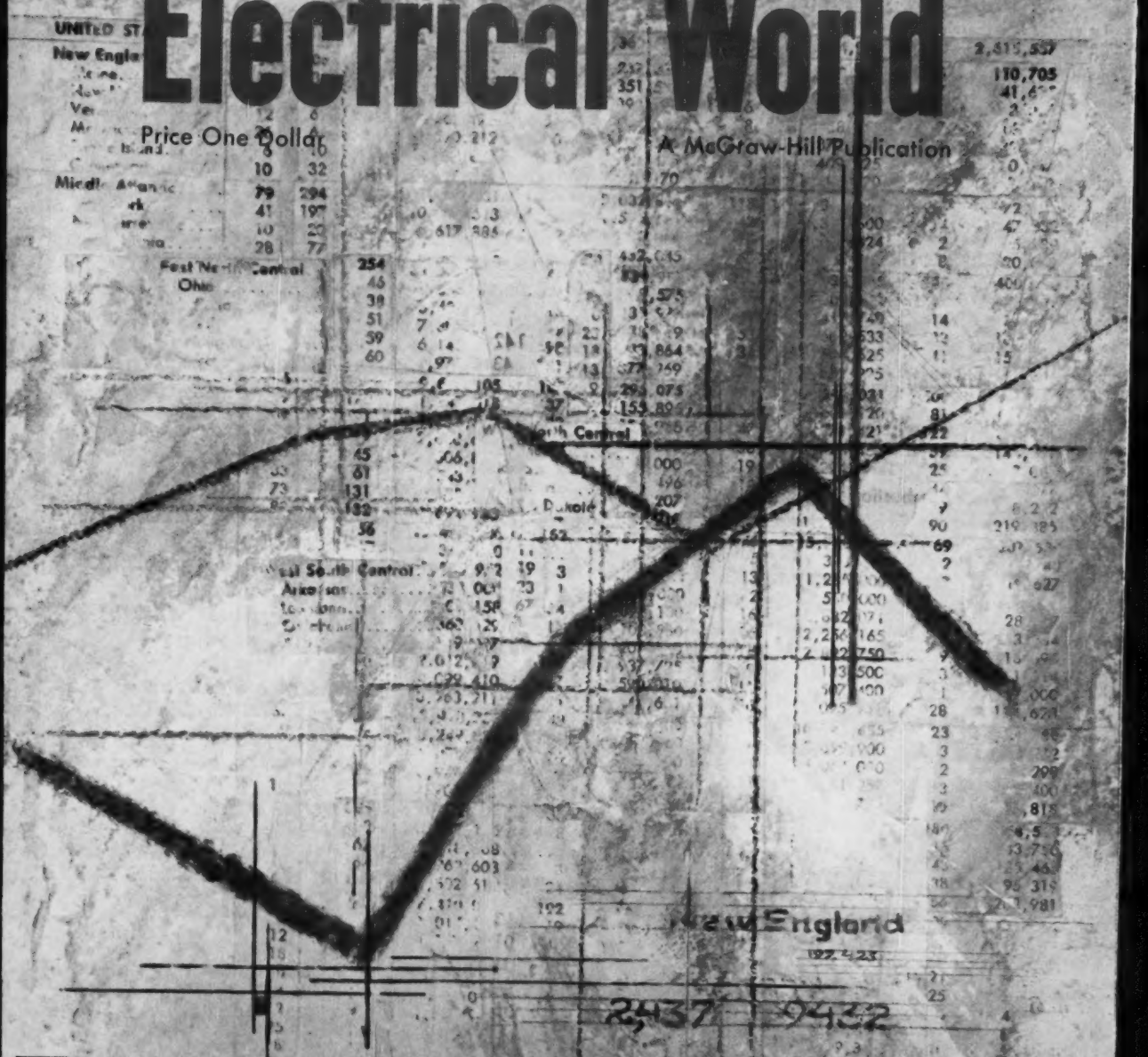
The Electrical Industry's Weekly Magazine January 25, 1960

Electrical World

Price One Dollar

A McGraw-Hill Publication



Electrical World Industry Statistics

36TH ANNUAL REPORT

Part 1

UNIV MICROFILMS INC
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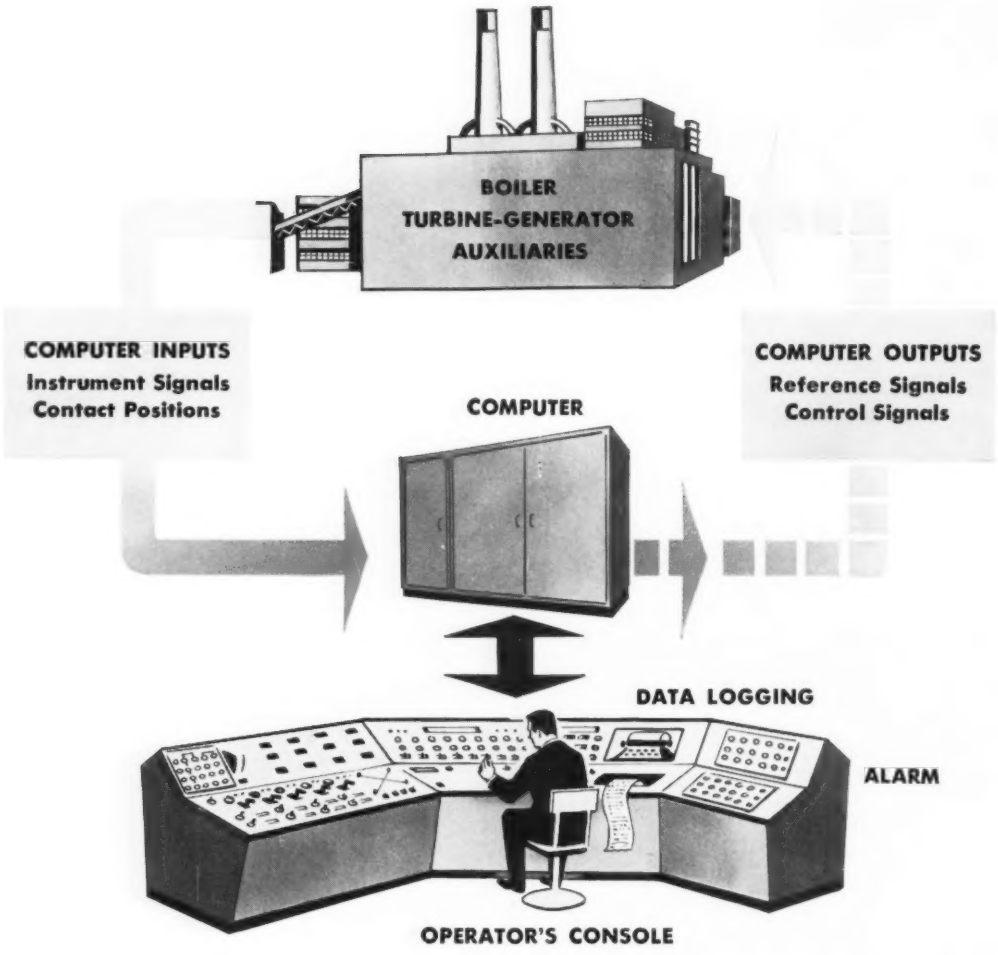
General Electric reports to the electric utility

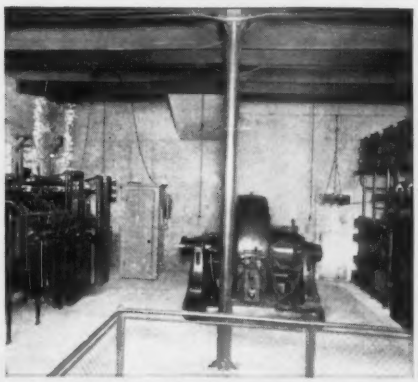


GENERAL ELECTRIC'S DEPTH OF EXPERIENCE IN SYSTEM DESIGN

General Electric's competence in power plant automation extends well beyond its ability to design and manufacture many of the complex components of the system.

81 YEARS OF EXPERIENCE in the utility field has given General Electric distinctive skills in integrating many and varied types of equipment into reliable and smoothly operating *systems*.

AUTOMATION DEVELOPMENTS pioneered by General Electric, in co-operation with its utility customers, cover all parts of the utility system, from generation through relaying to metering. A partial listing of such developments over the years would range from the automation of hydroelectric generating stations more than 40 years ago to the development, a few years ago, of automatic load dispatching systems.



FIRST AUTOMATIC SUBSTATION, at the Union Station of the Elgin and Belvidere Electric Company, was developed by General Electric in 1914. This was a fundamental contribution.

FIRST AU
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ty industry on progress in . . .

POWER PLANT AUTOMATION

AN ENGINEERING REALITY today, the automatic power plant was a dream until recent developments in solid-state digital computers supplied the missing element: a reliable "brain" compatible with already existing sensory devices and automatic sub-loops.

GENERAL ELECTRIC'S COMPUTER CONTROL SYSTEM now makes possible completely automatic hot and cold starting, on-line corrective action, normal and emergency shutdown, and continuous control of the boiler-turbine-generator-plant auxiliaries system.

BENEFITS TO BE EXPECTED from this advanced computer control system include reduced outages due to careful preplanning of programmed action to minimize undesirable operating conditions and human errors. Improved fuel economy should also result from the availability of continuous information on plant and component efficiencies, and from the allocation of load schedules in accordance with actual (instead of historical) operating conditions.

GENERAL ELECTRIC'S ENGINEERING COMPETENCE in the field of electric utility automation began early and has influenced all parts of generation, transmission, and distribution systems. This competence is solidly founded on the long-standing familiarity of General Electric engineers with basic phenomena in the generation, transmission, and distribution of electricity.

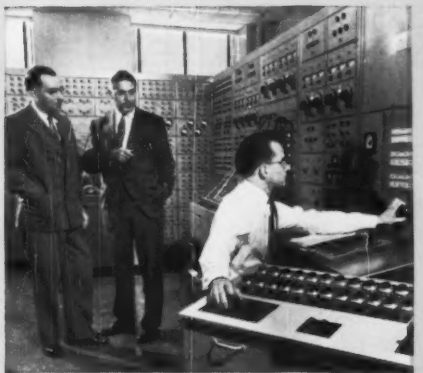
SEVERAL DEGREES OF POWER PLANT AUTOMATION are available to you now. General Electric will work directly with you or with your consulting engineer to design and co-ordinate anything from an improved and automatic data acquisition system to complete automation of your power plant.

For more information on this dramatic new development, write to the General Electric Co., Section 301–411, Schenectady 5, N. Y.

Progress Is Our Most Important Product

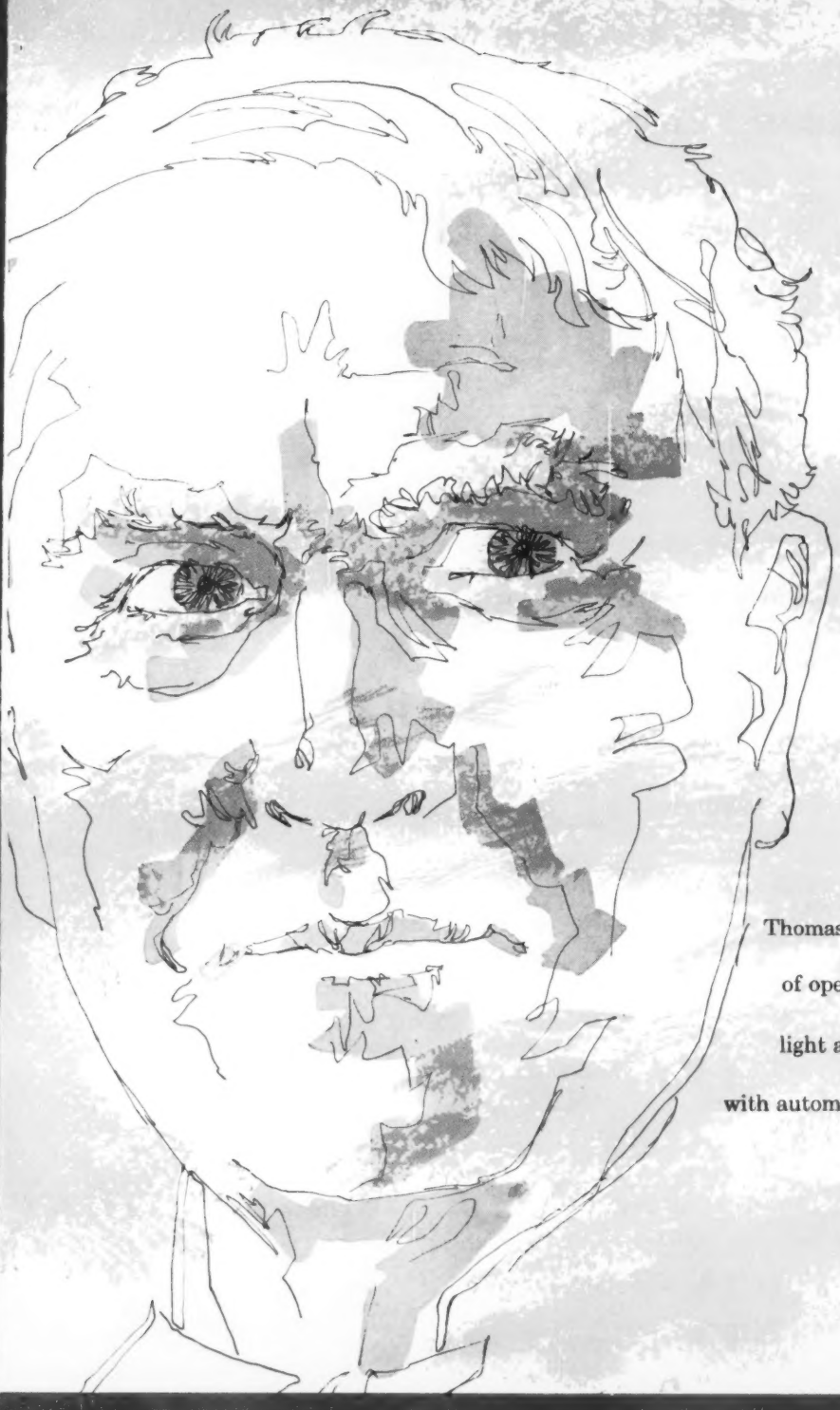
GENERAL ELECTRIC

T AUTOMATIC POWER PLANT, a hydro-ric plant, was installed at Cedar Rapids in . It was developed by General Electric for owa Railway and Light Company.



FIRST SYSTEMS PLANNING AID was offered to electric utilities over 40 years ago by General Electric. A-C network analyzers (above) have been used since 1929.

FIRST APPLICATION OF COMPUTERS to automating the design of heavy electrical apparatus was pioneered by General Electric. Computers help solve once unsolvable problems.



Thomas Edison dreamed of operating an electric light and power system with automatically governed operating units.

THE AUTOMATIC POWER PLANT is an engineering reality today

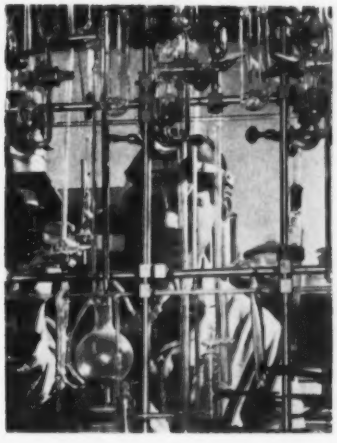
FOR DETAILS OPEN THIS FOLD...

Electrical World

Vol. 153, No. 4 JANUARY 25, 1960

Published for 86 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

In This Week's Issue



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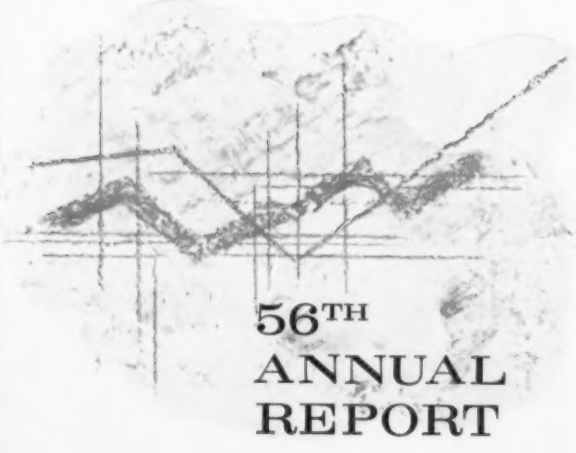

Electrical Industry Statistics– Part 1

Here is first look at utility 1960 budgets for capital expenditures. Comprehensive study includes regional breakdowns in each major category of construction, and summary of financial status for 1959.....p 69

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Revolving Aerial Ladders

WITH ELECTRIC-POWERED HYDRAULIC ELEVATION

Safe, easy operation of the HLE Ladder inspires confidence . . . enabling the user to work comfortably and thereby complete more overhead jobs every day.

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POWERS *American*

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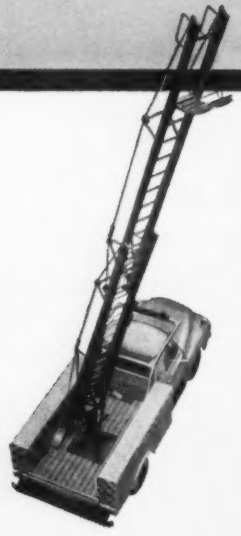
The range and ease of operation of this manually-operated unit, coupled with its safety, durability and trouble-free service, has made it a favorite with utility users everywhere.

Available in ground-to-platform heights of 23½′, 26½′ and 30½′ for installation on a body that fits your exact requirements.



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LETTERS

Systems Map Commended

To the Editor:

The map titled "Interconnected Systems of the U. S." which appeared in the Nov. 9, 1959 issue of Electrical World shows more clearly than any other I have seen the areas and relationships of the various interconnected systems and pools. . . .

Edward Frye
Assistant to the Secretary
Department of Interior
Washington 25, D. C.

A Student Looks at Prospects

To the Editor:

I was very interested in your article "Survey of the 60's," in the Dec. 28, 1959 issue of Electrical World. Being a Senior in Electrical Engineering at the University of Kansas and interested in some phase of utility work, I would like to comment on your editorial on page 57 of that issue.

You state that it has been difficult to attract highly competent young graduates into the electrical utilities in competition with the horn-blowing, PR-conscious, well-heeled firms in the so-called "glamor" fields. Perhaps my experience will give you a few hints on meeting the competition.

First, I am a veteran with a farming background, a good scholastic record, and am a member of several engineering honor societies. I have received several very good offers with training programs up to four years with the companies which supply the utilities (so you won't think I'm a misfit). Last summer I contacted five utilities and received replies from all five. Of the three I was able to interview, only one showed a real interest. The other two said they didn't know if they would need anybody until Spring and to contact them again in March. One company required its engineers to do all the drafting work. Another didn't even offer to show me its engineering department or introduce any of its engineers. . . .

Then of course there is the minor problem of pay. My offers and expected range of pay from utilities have consistently been $100 to $150 per month below stable industry offers. This does not include aircraft companies and the like, but established manufacturers. Now I don't intend to take a job just because it is the highest pay, but $100 to $150 per month is not a minor point. In addition, very few utilities have any training program at all, except maybe on the drafting board.

This, in my opinion, is part of the reason why utilities cannot attract the better college graduates.

Robert L. Hays
Route 1, Box 41
Lawrence, Kansas

▶ We doubt that Reader Hays' experiences are typical of the engineering student seeking a utility position. However, he does have an image of the industry which is altogether too widespread, and one which must be improved.

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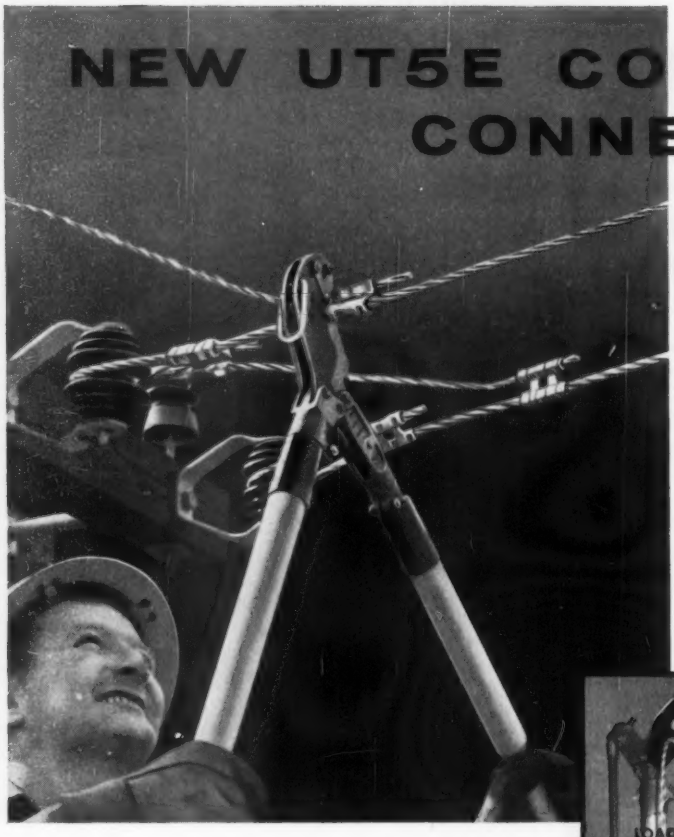
INSTALLS THE BIGGEST CONNECTOR RANGE EVER!



one mechanical compression tool that splices, taps, dead-ends, and terminates the complete range of conductors from #10 str. to 4/0 ACSR!

HOT LINE APPLICATION

QUICK! One stroke makes one perfect compression.

LIGHT! Complete tool weighs only six pounds!

SIMPLE! C-Shaped head with snap-in, color-coded dies is designed to simplify the job.

SAFE! Tool and connectors are designed with safety in mind.

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UT5E	Basic tool with metal handles
UT5W	Basic tool with wood handles
UT5H4	Basic tool with 4 ft. hot stick handles
UT5H6	Basic tool with 6 ft. hot stick handles

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†Trade Mark

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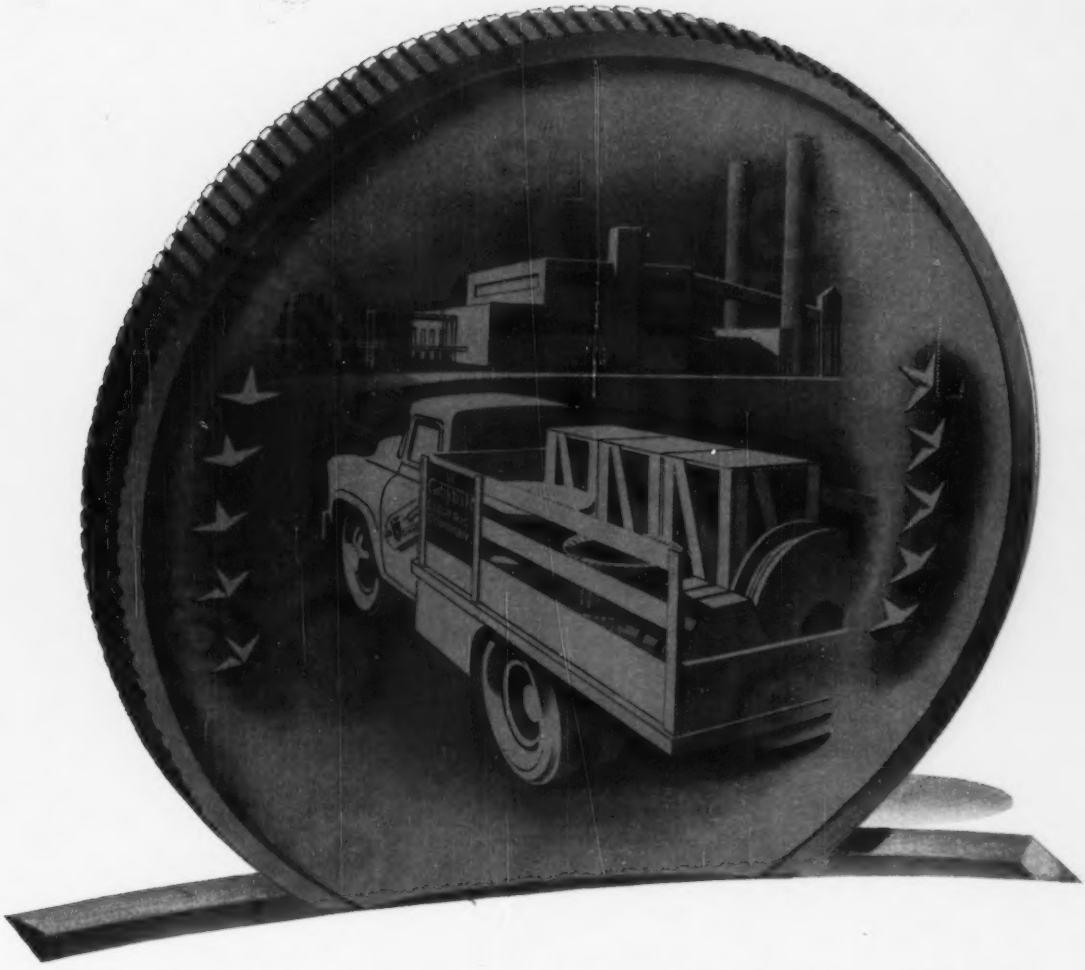

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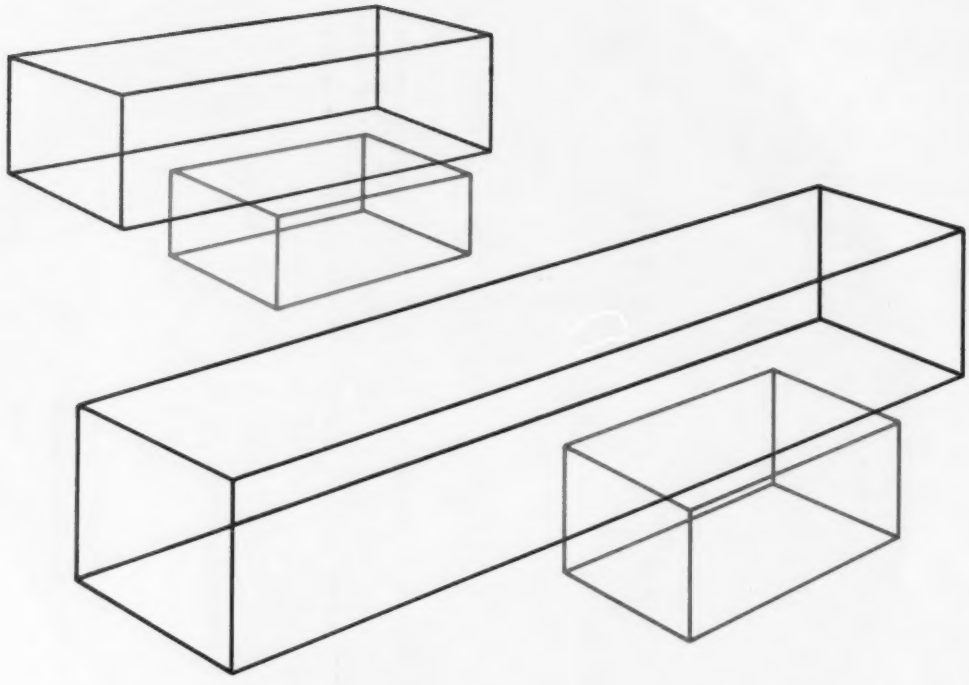

The problem of the diminishing ratio

Twenty years ago, when 60 mw was a big generator, there was plenty of room in the foundation for the surface condenser. Even with round shell or heart-shaped units that didn't take full advantage of the rectangular opening, space was no problem.

But as generator capacity increased, so did the efficiency of the turbines. Energy output multiplied faster than physical size. Hence the ratio of available condenser space to generator capacity got smaller—and smaller—and smaller.

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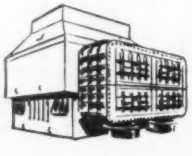
Whatever your condenser problem, it can benefit from Ingersoll-Rand's *experience* and *imagination in design*—aided by the most modern condenser design and research facilities in the world. Ask your Ingersoll-Rand engineer for complete information.



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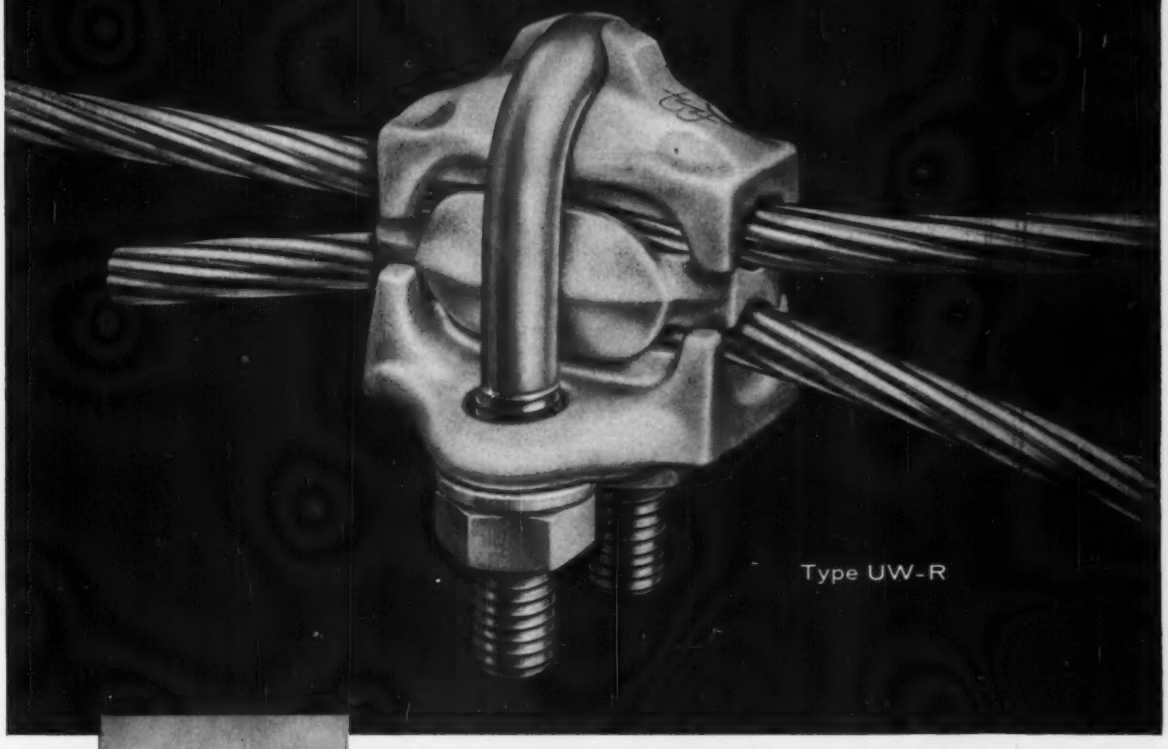

Generous wrap-around CLIPIT spacer, coated with corrosion inhibiting compound, assures good conductivity when using CLIPIT as a tap connector

The high strength aluminum alloy CLIPIT deadend offers low cost, easy installation, wide range and versatility.
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- All parts of the CLIPIT are mutually self aligning.
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- Wide belled cable entrances of CLIPIT reduce stress points and minimize cold flow. Ears of caps confine cables, prevent splaying.

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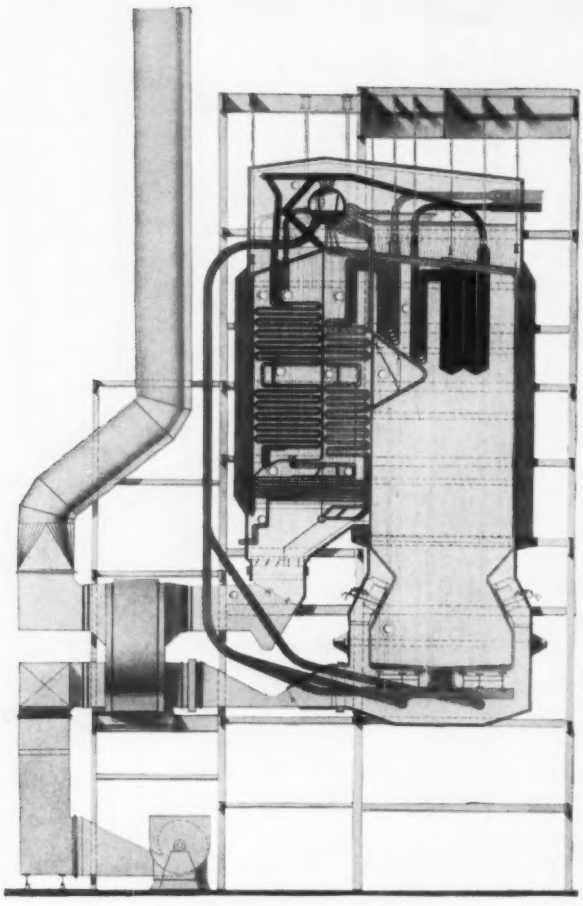
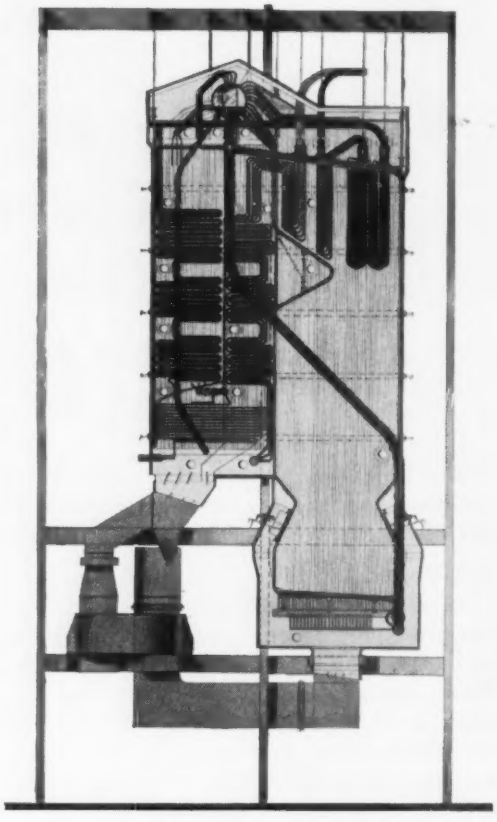
How The RILEY TURBO FURNACE



Texas Public Utility — 1,200,000 lbs/hr
1005/1005F; 2125 psig — Gas or Oil Fired

- Permits the use at any time of the most economical fuel available — a wide range of coals, lignite, fluid coke, natural gas, blast furnace gas, oil.
- Complete burn out of all combustible material virtually eliminates combustible loss.
- Nearly equal furnace performance with oil, gas or coal firing simplifies steam temperature control.



Florida Public Utility — 600,000 lbs/hr
1005/1005F; 1650 psig — Gas and Oil Fired

A FEW TURBO FURNACE CENTRAL STATION BOILERS INSTALLED AND UNDER CONSTRUCTION

*Delaware City Power Station
Delaware Power & Light Company
Delaware City, Delaware
Units No. 1, 2, 3

*Permian Basin Steam Electric Station
Texas Electric Service Company
Monahans, Texas

*Sterlington Steam Electric Station
Louisiana Power & Light Company
Sterlington, Louisiana

Rockwell Station, Unit No. 6
Manila Electric Company
Manila, Philippine Islands

*North Lake Steam Electric Station
Dallas Power & Light Company
Dallas, Texas
Two (2) Boilers

*Turner Unit No. 4
Florida Power Corporation
Enterprise, Florida

*Little Gypsy Steam Electric Station
Louisiana Power & Light Company
Little Gypsy, Louisiana

Agua Fria Station, Unit No. 3
Salt River Power District
Phoenix, Arizona

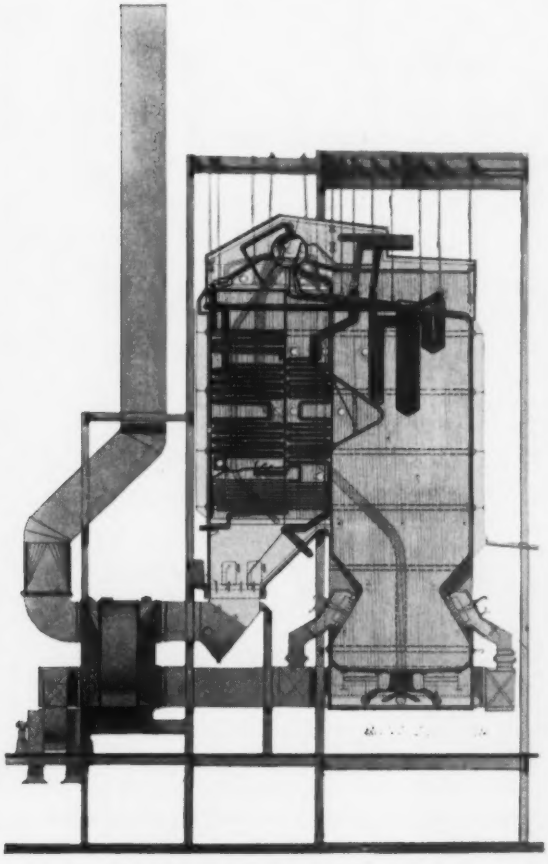
Michoud Steam Electric Station
Unit No. 2
New Orleans Public Service, Inc.
New Orleans, Louisiana

*Installed

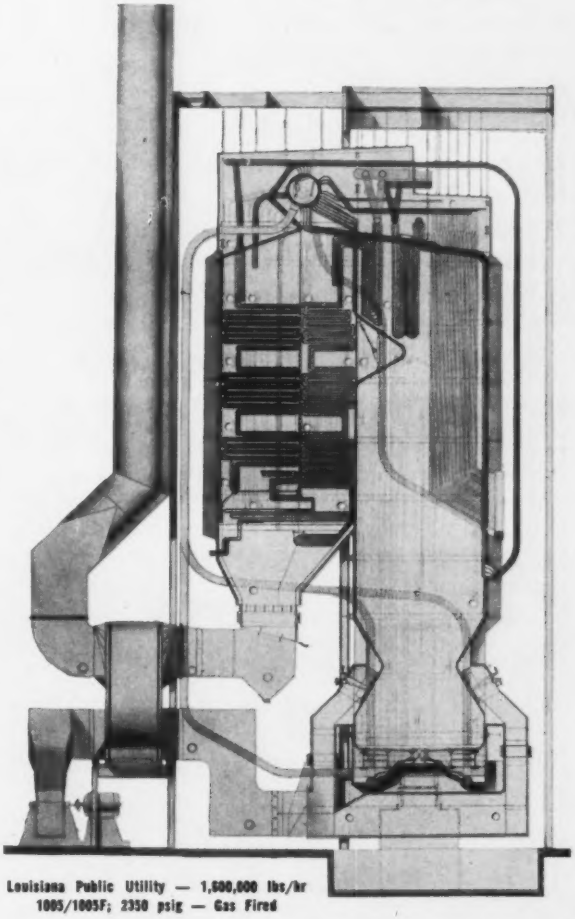
A survey of your plant by a qualified consulting engineer could show ways of making surprising savings in your power costs.

Helps To Lower The Cost Per KWH

- Flyash reinjected into furnace bottom eliminates cost of disposal, recovers combustibles. Quenched granulated slag is saleable.
- Prompt ignition and stable flame, even under adverse conditions, assure safe operation.
- Permissable higher furnace heat release rates result in smaller structures for given capacities.
- Almost entire absence of furnace wall deposits eliminates need for wall blowers, sustains high furnace efficiency, keeps uniform furnace performance.
- Opposed firing and uniform firing across the entire furnace width remove the limitations on furnace widths inherent in other firing methods.
- One level burner operation results in lower building costs and ease of operation.



Texas Public Utility — 825,000 lbs/hr
1005/1005F; 1750 psig — Gas and Oil Fired



Louisiana Public Utility — 1,600,000 lbs/hr
1005/1005F; 2350 psig — Gas Fired

RILEY STOKER CORPORATION WORCESTER, MASSACHUSETTS

Sales Offices

Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Jacksonville, Kansas City, Los Angeles, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Salt Lake City, San Francisco, Seattle, St. Louis, St. Paul, Syracuse, Worcester.

RILEY

STEAM GENERATING & FUEL BURNING EQUIPMENT

Introducing . . .

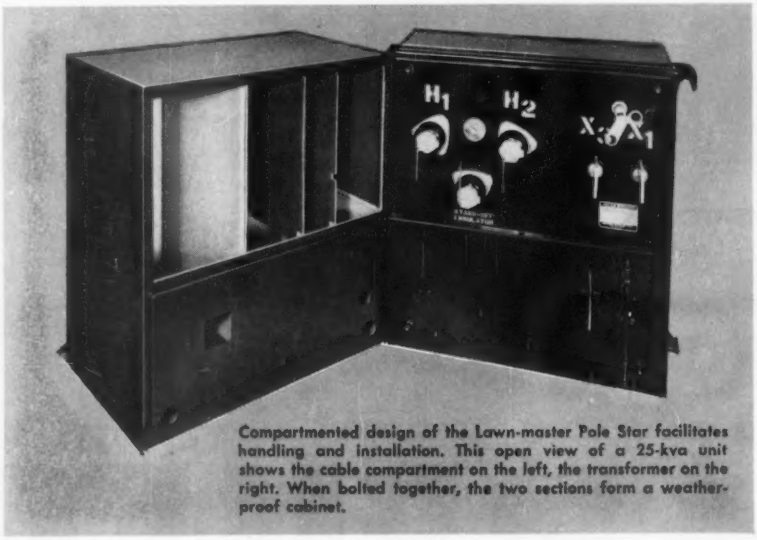
PENNSYLVANIA'S NEW *Lawn-master* POLE STAR

The Surface-mounted Transformer designed with PEOPLE in mind

- **Convenient surface unit for modern, underground distribution systems**
- **Compact, view-enhancing—easy to camouflage with shrubbery, small trees**
- **Easily uprated—each compartment accommodates three different kva ratings**
- **Trouble-free and safe for any location—completely enclosed, with no sharp projections**

Pennsylvania's Lawn-master Pole Star is a transformer designed for "better living" in the fullest possible sense. Specifically intended for use with underground distribution systems, the Lawn-master Pole Star is compact and unobtrusive. Thus, it does not detract from the open vistas created by the elimination of poles and overhead wires.

The Lawn-master Pole Star will provide the continuity of service that homeowners and other power users can expect as a result of underground distribution. All live parts are completely contained in the grounded, weatherproof compartment, thus making the Lawn-master perfectly safe in *any* location, from parking lots to playgrounds. Internally, the Lawn-master features the time-tested Pole Star assembly—with the recently improved "echelon lap" core, which attains new highs in electrical efficiency.



Compartmented design of the Lawn-master Pole Star facilitates handling and installation. This open view of a 25-kva unit shows the cable compartment on the left, the transformer on the right. When bolted together, the two sections form a weatherproof cabinet.

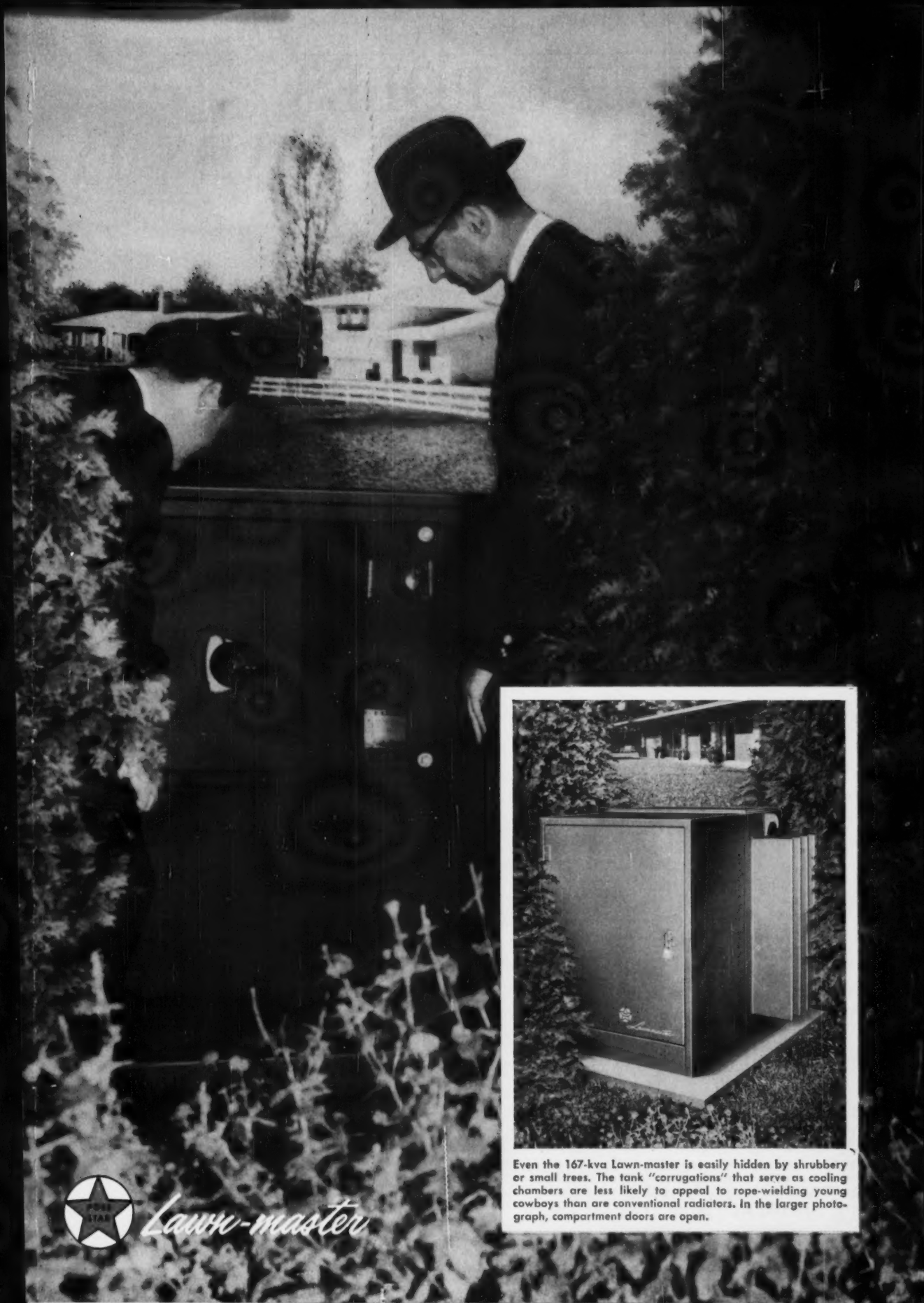
Compartmented design simplifies the handling and installation of Lawn-master Pole Stars. If desired, the cable compartment alone can be installed and then the transformer can be added when service is required. Each compartment accommodates three different kva ratings, so that future expansion is easily accomplished.

Available ratings include all standard sizes from 25 through 167 kva, single phase, and 75 through 500 kva, three phase—15 kv and below. Optional equipment includes transfer switches, standoff insulators and lightning arrester mounting brackets.

For additional information on the Lawn-master Pole Star — the transformer designed with *your customers* in mind—contact Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.

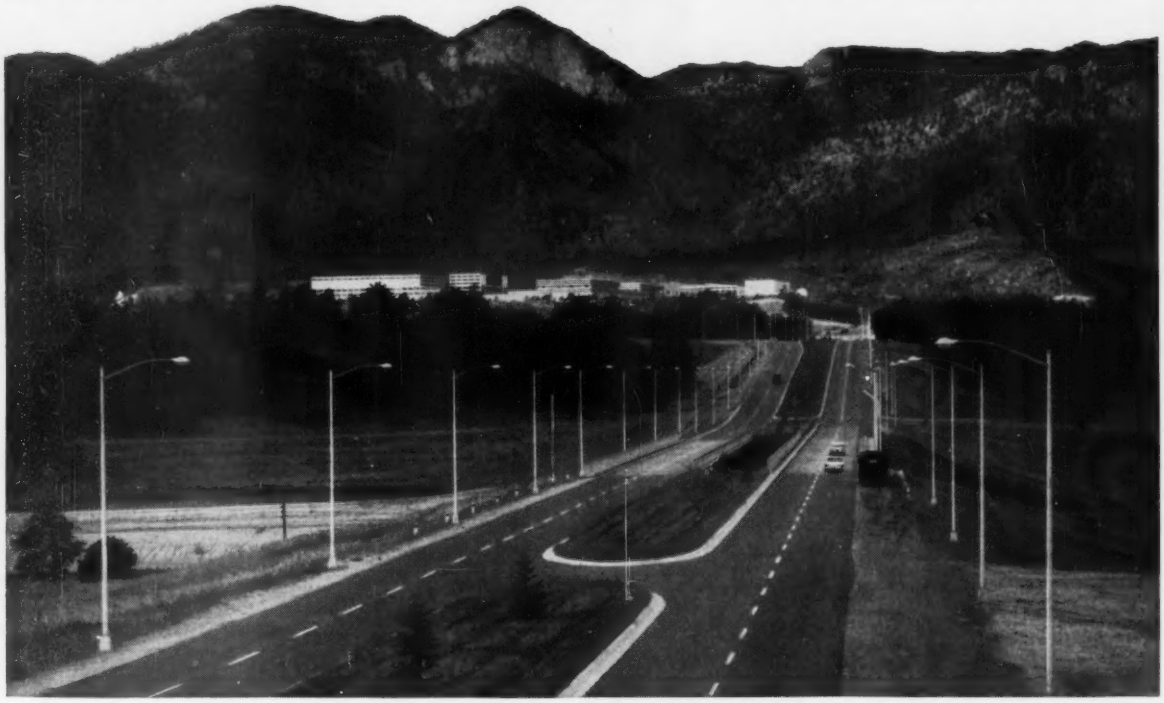
McGRAW EDISON

PENNSYLVANIA DISTRIBUTION TRANSFORMERS



Even the 167-kva Lawn-master is easily hidden by shrubbery or small trees. The tank "corrugations" that serve as cooling chambers are less likely to appeal to rope-wielding young cowboys than are conventional radiators. In the larger photograph, compartment doors are open.

MONOTUBE POLES FOR AIR FORCE ACADEMY



ROADWAY leading from the North Gate to the Cadet-Academic Area.

PARKING AREA on the Academy grounds.

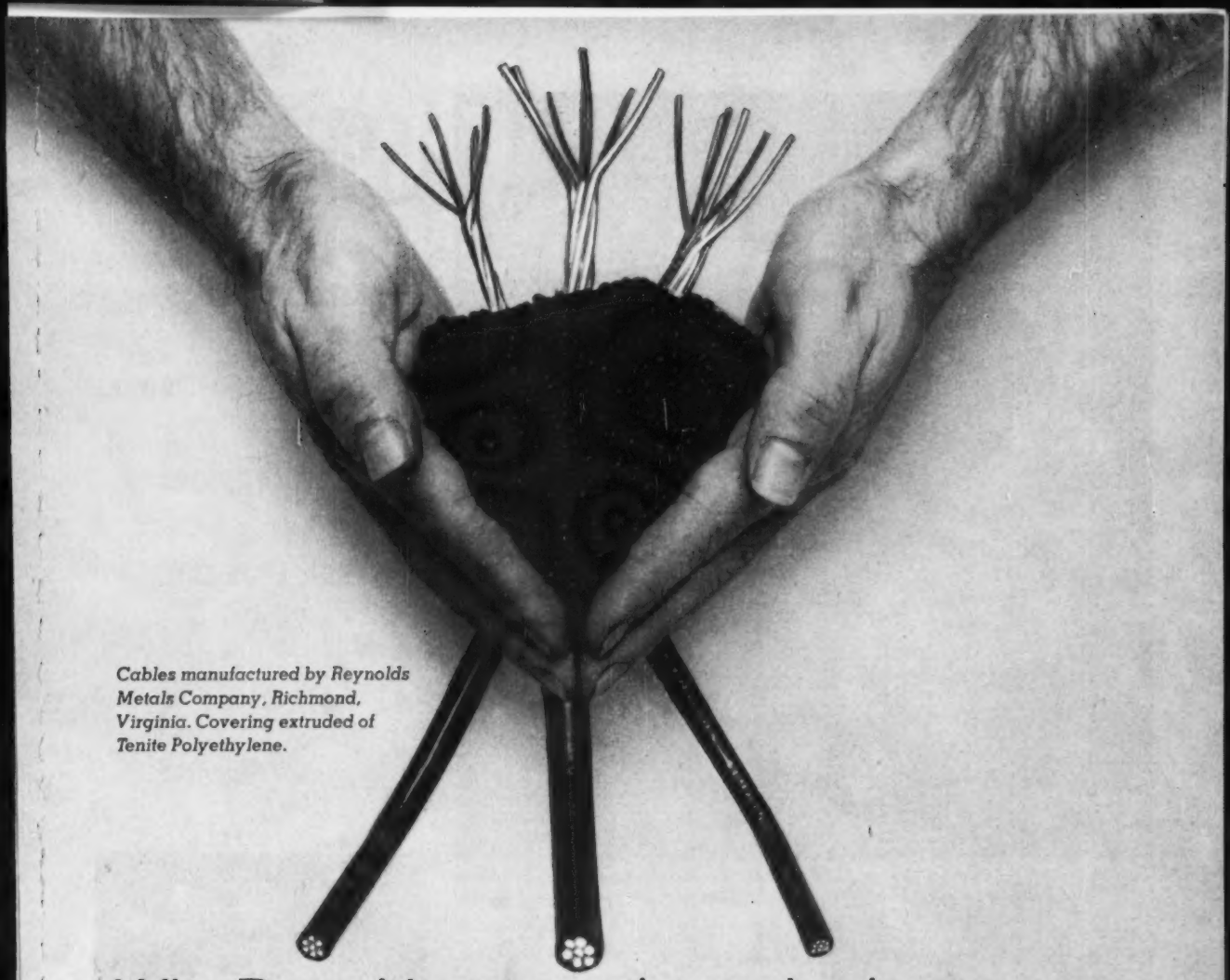
ATHLETIC FIELDS use 60′ and 100′ steel poles.

Installations throughout the country prove Monotubes offer the utmost in styling, strength and service.

UNION METAL

The Union Metal Manufacturing Co.
Canton 5, Ohio • Brampton, Ontario

Monotube Engineered Lighting Poles



Cables manufactured by Reynolds Metals Company, Richmond, Virginia. Covering extruded of Tenite Polyethylene.

Why Reynolds covers these aluminum conductors with TENITE POLYETHYLENE

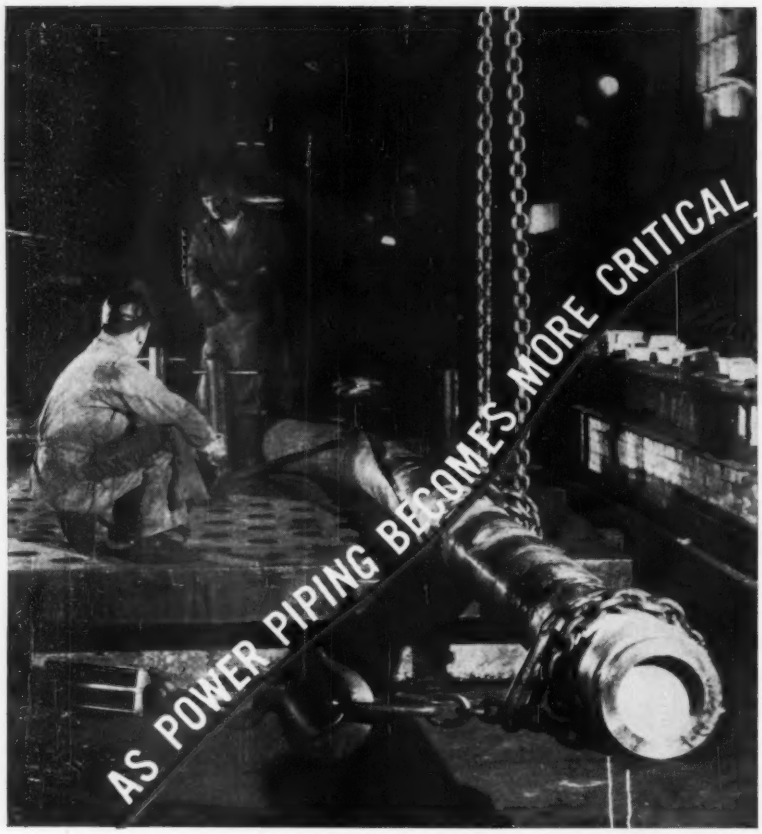
To obtain the highest possible performance from their secondary distribution and service line cables, Reynolds Metals Company chooses Tenite Polyethylene as a covering material.

Tenite Polyethylene is manufactured under as rigid a system of quality control as Reynolds' own aluminum conductors, and makes a tough, weatherproof, fast-stripping covering material which offers high dielectric strength and resistance to abrasion, heat, moisture, chemical attack and stress cracking. It remains flexible even at sub-zero temperatures and its light weight permits easy handling and wide spans. Users report that it gives long service life without festooning or splitting.

Tenite Polyethylene is easily extruded as jacketing or insulation for many diverse applications, from coaxials to control cables, from TV lead-ins to telephone wires. For a material with outstanding electrical, physical and chemical properties, specify Tenite Polyethylene. For further information, write EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

Both natural and black electrical grade Tenite Polyethylene are available to cable manufacturers in a unique spherical pellet form which flows freely in the extrusion process and in "air-veying" of bulk shipments from truck to bin.

TENITE®
POLYETHYLENE
an Eastman plastic



A length of stainless steel piping is bent to close tolerances at Kellogg's Jersey City shops. Dam in pipe end retains inert gas introduced to prevent oxidation.

KELLOGG'S PIPE BENDING TECHNIQUES KEEP PACE

Bending stainless, chrome-moly, and carbon steel power piping to meet exacting specifications of length and wall thickness, as well as contour, is a Kellogg skill reflected in a higher quality and lower cost product.

Among the advanced fabricating techniques pioneered by Kellogg at its Jersey City shops is the use of inert gas to purge pipe interiors of oxygen during the heating and bending cycle. This technique assures freedom from internal scaling and provides a clean interior surface.

By its ability to predetermine bending effects such as pipe wall thinning, cross section variations and pipe stretch, Kellogg maintains specification requirements and top quality while minimizing bending costs.

Kellogg welcomes inquiries on its complete design, fabrication, and erection service to the power piping industry from consulting engineers, engineers of power generating companies, and manufacturers of boilers, turbines, and allied equipment.

Operator checks pressure of inert gas being forced through piping during heating to prevent internal scaling. Gas is also retained in the piping during bending.

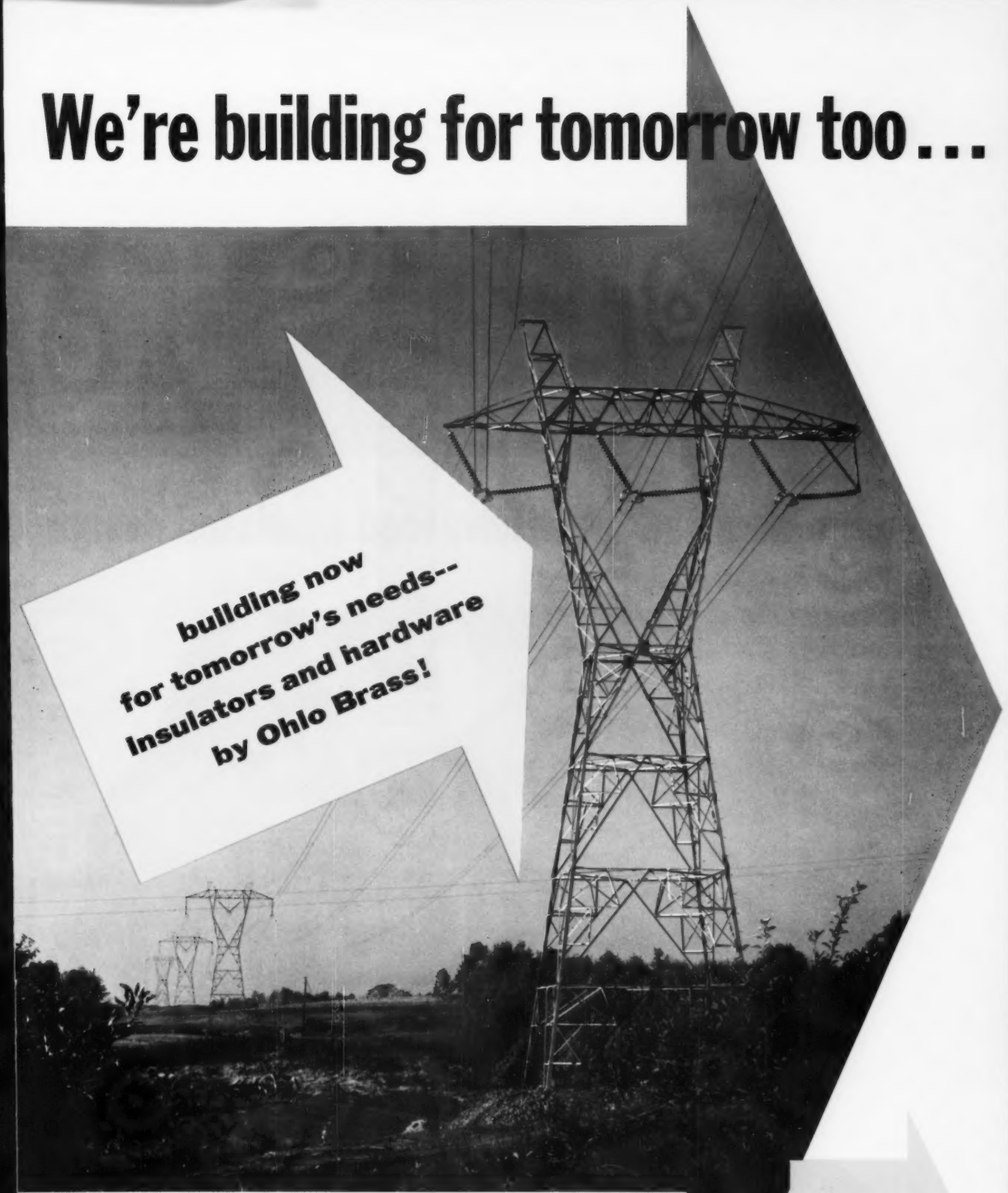
THE M. W. KELLOGG COMPANY, 711 THIRD AVENUE, NEW YORK 17, N. Y.

A SUBSIDIARY OF PULLMAN INCORPORATED

The Canadian Kellogg Co., Ltd., Toronto • Kellogg International Corp., London • Kellogg Pan American Corp., Buenos Aires • Societe Kellogg, Paris • Companhia Kellogg Brasileira, Rio de Janeiro • Compania Kellogg de Venezuela, Caracas

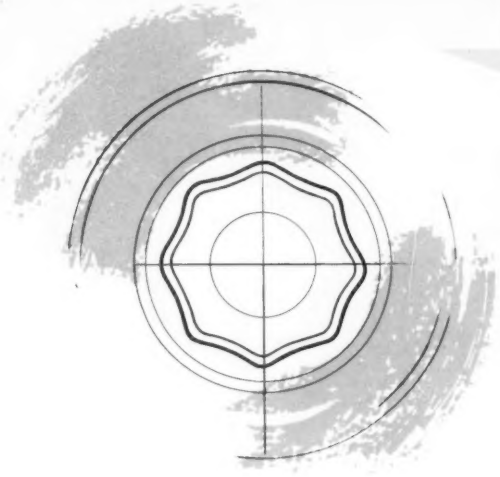
POWER PIPING—THE VITAL LINK

We're building for tomorrow too...



Ohio Brass HOLAN

PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS
BUSHINGS · HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES



There has never been another insulator like this one! There will be others similar to it in the future, no doubt, since O-B design improvements have a habit of setting industry trends (beginning with our introduction of the first modern cap-and-pin suspension insulator in 1909). Behind this insulator, however, are 30 years of specifically oriented research and 15 years of field service experience. Built into it is more strength per pound - - mechanical and electrical - - than any insulator we've ever made, and a type of corrosion protection that assures the enduring permanence of this greater strength.

To achieve the quality control, the product uniformity demanded by the Futura design - - to build this extra value into a competitive price - - we built the industry's most modern, most efficient mechanized production line.

...building the most advanced insulator design

OHIO BRASS

FUTURA

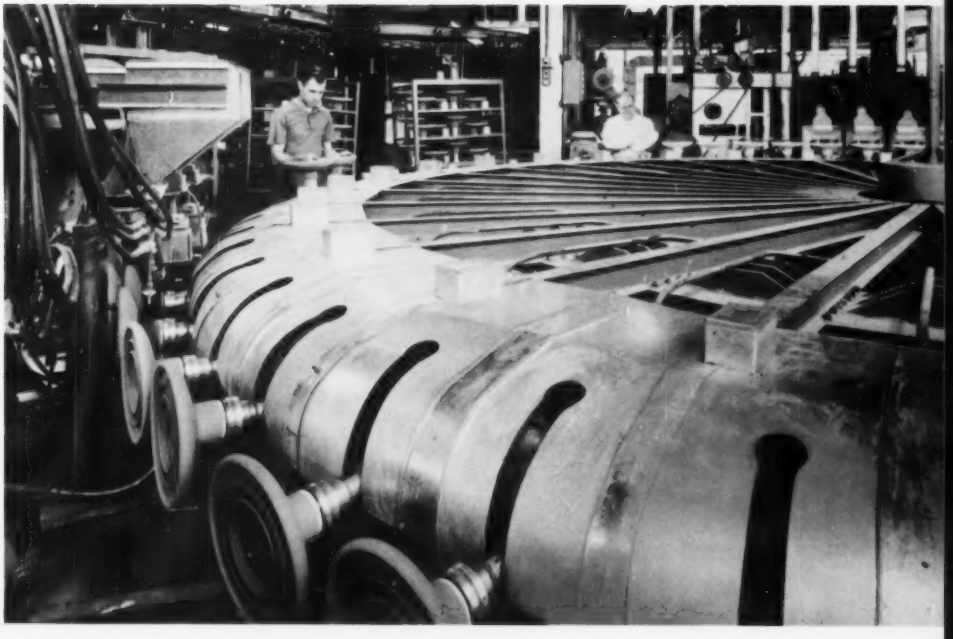
Suspension Insulators with CIS*

Available with M & E strength ratings of 18,000, 25,000 and 36,000 pounds.

* Corrosion Intercepting Sleeve

Mechanized conveyor, part of a mile-and-a-quarter-long synchronized conveyor system, lifts newly formed insulator shapes to a mold release dryer. Very high product uniformity results from a degree of quality control never achieved before.

..on the industry's most efficient production line!



Multiple operations performed by this giant wheel prepare insulator bodies for kiln firing. While electronic eyes and vacuum lift "hands" control product movements far more precisely and delicately than any human eyes or hands, all stages of manufacturing and testing are observed by a trained staff of experienced inspectors.

Ohio Brass HOLAN

PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS
BUSHINGS · HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES

1/100,000,000 of a second before flashover! string of insulators under test in the O-B lab

...building on 50 years experience with 50,000,000 suspension insulators!

In the course of 50 years' experience with more than 50,000,000 suspension insulators, Ohio Brass has developed research and test facilities unequalled by any other manufacturer.

The contributions of the O-B High Voltage Laboratory and the O-B Ceramic Research Laboratory, for example, have profoundly influenced the development of better insulators and insulator hardware throughout the industry. They have also helped to solve many other problems related to the development of more efficient power transmission and distribution systems.

These facilities, this vast fund of scientific knowledge and hard-won experience, have given Ohio Brass a head start on the problems of tomorrow.

OHIO BRASS COMPANY, MANSFIELD, OHIO
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

Ohio Brass (B) HOLAN

PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS
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10021-H

The Electrical Week

FUTURE NEWS ▶ **Two big A-plants—in the 200-Mw range—may be in the offing.** The plants are being considered individually by two well known utilities.

LATE NEWS ▶ **Washington Wire** . . . Senate Interior Committee will hold hearings on Sen Murray's bill (S-2549) to create an executive council on resources and conservation, and a Joint Congressional Committee on Resource Development . . . FPC orders two power companies—South Carolina E&G and Portland General Electric—to show cause why they shouldn't be found in violation of income tax deferral rules . . . Sen Clair Engle introduces bill to build Stanilaus River Development as part of Central Valley Project . . . FPC okays California Oregon Power request to include four hydro plants in single 50-year license for Big Bend Development.

EEI to exhibit at 1964 World's Fair in N. Y. Details at later date.

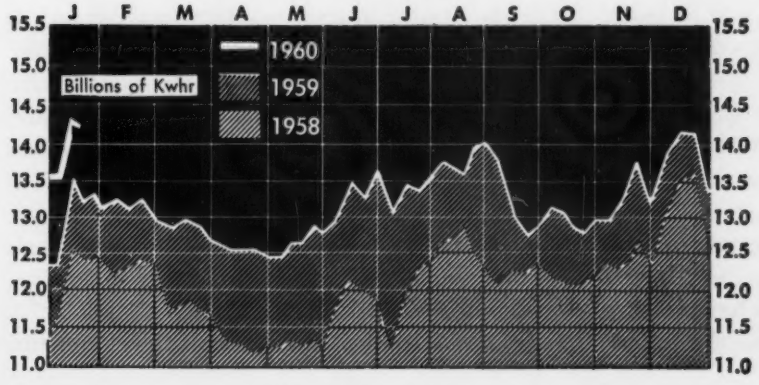
Memphis LG&W must keep rate increase funds in separate account, Chancellor Robert Hoffman ruled recently. Action clears the way for court to decide whether 18.5% hike will be allowed to stand.

Another public-vs-private power fight shapes up in Kentucky legislature as bill is introduced to repeal Everett Act, prohibiting municipalities from going into competition with private utilities. Consensus is that fate of the repealer depends on position taken by Gov Combs.

The 22-story Merchandise Mart in Atlanta will be all-electric. The mammoth building, to be served by about 400 heat pumps, will contain high intensity lighting in all display areas.

Management changes . . . GE names F. K. McCune vp-engineering services . . . Sylvania appoints A C Viebranz vp-marketing . . . Wagner shifts H. N. Felton from vp-sales to vp-marketing and makes R W. Boeringer, vp-industrial relations.

WEEKLY POWER OUTPUT—Up 6.8% (Week ending Jan. 16), Kwhr 14,236,000,000



Per Cent Change From Previous Year

	Jan. 2	Jan. 9	Jan. 16
Total U. S.	+ 9.7	+ 5.6	+ 6.8
New Eng.	+ 6.0	+ 1.5	+ 5.8
Mid. Atlan.	+ 8.7	+ 6.0	+ 7.8
Cent. Ind.	+10.7	+ 7.1	+ 8.4
West Cent.	+ 7.9	+ 3.1	+ 5.7
Southeast	+ 7.7	+ 3.1	− 1.1
South Cent.	+10.7	+ 6.7	+ 8.2
Rocky Mount.	+ 8.4	+ 2.6	+ 9.2
Pacific			
NW	+13.8	+ 2.1	+11.3
SW	+13.8	+14.5	+18.4

Seasonally Adjusted Index 260.9

Week Ago 261.7 Year Ago 244.2

Source: Edison Electric Institute

Preview of This Issue

EVENTS ▶ **Federal spending is headed upwards** on projects linked with power. President wants money for new starts on Yellowtail, Blue Mesa, Green Peter dams. A $20-million deficiency in REA's request is expected to raise some eyebrows (p 62) . . . Puerto Rican agency gets go-ahead on 16.3-Mw superheat reactor (p 64) . . . Public power's goals defined in Washington meeting (p 65) . . . Con Ed gets $14-million rate increase (p 124).

SPECIAL REPORT 56TH ANNUAL STATISTICAL REPORT PART I ▶ **Highlights of Part I of EW's 56th Annual Statistical Report (p 69):** The nation's electric utilities expect to spend $4.9 billion for new construction in 1960, 4.9% or $231 million more than in '59. Major expenditures are slated to change as follows:

- **Generation,** still the largest item in the building budget, will drop 3.9% to $2.28 billion. This results from a 7% drop in steam plant spending while hydro climbs 4.5% to $726 million.
- **Transmission**—up $105 million, or 14.8% to $813 million.
- **Distribution**—up $182 million, or 12.9% to $1.6 billion.

ENGINEERING ▶ **Research must develop better dielectrics** to extend the capabilities of 345 and 500-kv cables beyond thermal limits imposed by losses in oil-paper insulation. Plastics, synthetics are being studied (p 66).

Politics and Public Power

TWO DEVELOPMENTS AFFECTING CO-OPS

Two recent developments—one in Washington, the other in Denver—have implications for the future of rural electric cooperatives which all persons and parties interested in them would do well to watch.

The first of these is a plan by key Democrats on the House Ways and Means Committee to push legislation that would increase federal taxes on incomes of all co-ops, not only the rural electrics.

The plan is said to have the approval of Ways and Means Chairman Wilbur Mills (D-Ark.). Hearings will begin on it on Feb. 1 for one week. Basically, it envisages a change in the status of the certificates of worth which many co-ops issue their members in lieu of cash earnings. These certificates state each member's share of the co-ops earnings. The proposed change in the Democratic plan would be to consider them as cash. The members would then have to pay federal income taxes on them, even if they never receive any money in lieu of the certificates.

At present, there is mixed feeling among committee members about how the co-ops would receive the plan.

The Treasury, meanwhile, has proposed another plan that would increase co-op taxation. Under it, taxes would be waived on all certificates which are redeemable within three years. The co-op member would then pay taxes on the dividends when they are actually received. Democrats on the committee, however, oppose Treasury's plan on the grounds that it might prove a hardship on some co-ops if they are required to pay off their certificates within three years.

The second of these recent developments

PROCUREMENT & PRODUCTS ▶ **Public utility buyer groups to meet next week in Atlanta** to discuss pricing, steel and substitute materials, etc . . . Grand Jury probing pricing policies expected to wind up its work in late February (p 92) . . . Federal court dismisses patent suit of Preformed Line Products against Fanner Mfg . . . Daystrom computer equipment at Louisiana P&L Sterlington Station achieved 99.75% reliability (p 94) . . . Regulators feature lighter weight and reduced size . . . Interruptor switch features springloaded, heavy duty, self-aligning contact fingers (p 105).

MANAGEMENT ▶ **Looking for ways to revamp your management structure?** Check into this week's Management Newsletter (p 127), which details the plans and some of the results of a revision at Arizona Public Service which eliminated the company's conventional line-and-staff set-up.

SELLING ▶ **Medallion Homes are put up right on display floor of Home Show** in Miami. Result: More business for appliance dealers, electrical contractors and builders (p 121).

NEXT WEEK ▶ **The world's largest gas turbine generating plant,** on the British Columbia Electric Co system, will be the subject of a 4-page article.

has been the increasing amount of ill will between rural electric co-ops and municipally owned electric systems, engendered principally by the question of who shall serve those rapidly developing fringe urban areas that were, until a few years ago rural.

In an effort to head off the controversy before it becomes nation-wide, the American Municipal Assn has proposed the formation of a joint committee with the National Rural Electric Cooperative Assn to consider it.

The AMA, at its 36th annual congress in Denver last month, passed a resolution recommending the formation of such a joint committee, and "that said committee meet at the first opportunity for the purpose of adopting and recommending to the two organizations a set of principles designed to help resolve the present controversies between rural electric systems and municipal corporations in certain states."

Texas and Georgia are two states which have been making the biggest headlines in this regard. NRECA's Minuteman Newsletter, however, refers to them as "guinea pig" states in a nation-wide conspiracy (presumably by city-owned systems and private companies franchised in the cities) to do away with other power suppliers.

NRECA claims the co-ops are only trying to find some way to protect the territory they already serve. If they are kicked out by a city expanding its limits, "this jeopardizes the rate structures, the engineering plan or even the feasibility of what's left of the co-op."

The Minuteman Newsletter claims the real trouble is the 1,500-population limit in the REA Act. Perhaps this is the first step in a co-op attempt to get this portion of the Act repealed. In any case, the whole matter deserves more attention than it is now getting.

Executive Reader

Setting a value on executive performance using a planned performance approach offers these advantages over earlier attempts at executive appraisal: Long and short-term company objectives are a part of the process; job responsibilities are the basis for setting individual targets; outstanding and poor performers receive primary attention; personality plays a less important part in final evaluation; and mathematical bases provide guidance rather than final decisions. **How to Appraise Executive Performance, Arch Patton, Harvard Business Review, January-February 1960.**

A gas air conditioner in three to six-ton sizes for the home may reach the market in 1961, reports Robertshaw-Fulton Controls Co. This unit will use a free-piston compressor that will burn natural or bottled gas. Simplicity of the free-piston compressor is expected to permit manufacture of an air conditioner competitive with other types, including electric-driven, as to first cost, dependability and quietness of operation. **Gas Age, January 7, 1960.**

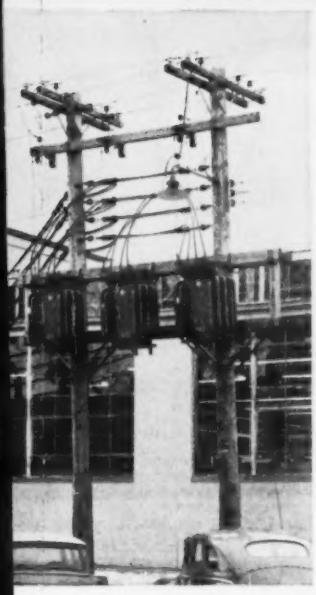
Mathematical concepts of controlling power generation and power flow with high-speed digital computers so that power is produced at minimum fuel and labor cost are developed in a new book on interconnected system control. The book describes the application of mathematical theory and associated engineering to several recent installations of power-control computers and computer-control equipment. **Economic Control of Interconnected Systems, Dr. L. K. Kirchmayer, John Wiley & Sons, Inc, New York City, and Chapman & Hall, Ltd, London.**

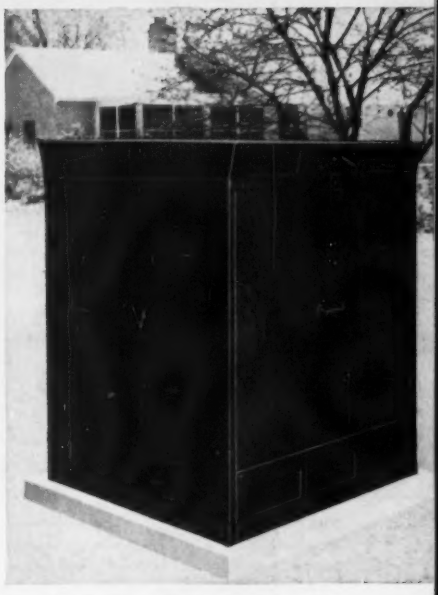
Upwards of 200 American engineering and science students are expected to apply for foreign training positions for the 1960 program of the International Assn for the Exchange of Students for Technical Experience (IAESTE). To place these students abroad, the U. S. IAESTE Committee must have an equivalent number of training opportunities for students from foreign countries under this reciprocal program. **U. S. IAESTE Committee, Engineers Joint Council, 29 W. 39th St, New York 18, N. Y.**

A monograph on electricity's ten founders has been reprinted and is again being offered. The illustrated work, "Ten Founding Fathers of the Electrical Science," was prepared by Dr. Bern Dibner, fellow of AIEE and director of the Burndy Library. Biographically sketched in the monograph are Gilbert, von Guericke, Franklin, Volta, Ampere, Ohm, Gauss, Faraday, Henry, and Maxwell. The 48-page publication is available for $1.00. **Burndy Library, Norwalk, Conn.**

Ten 500-Mw turbines will comprise a power station being built by the Russians near Krasnojarsk on the Jenissei River. Cost of power from the 5-million kw station is expected to be 0.5 kopek per kw (about 1.25 mills). Preliminary operations for the layout of the gigantic basin already have been concluded. **McGraw-Hill World News, Zurich.**

from THIS.....to THIS.....or THIS!





APPEARANCE is one important reason for going from overhead to underground construction. Today, the utilities working with Line Material have equipment available such as this L-M 12 kv, 300 kva, three-phase Pad-Mount transformer to replace the older-style pole-mounted bank.

ANOTHER SOLUTION to unsightly overhead banking is the Line Material Transclosure. Originally designed for either standard single or three-phase, pole-type distribution transformers, it can also be used singly or ganged to provide as much space as is needed for switching and protective devices.

New Developments Continue L-M Leadership in Underground Distribution Equipment

L-M Engineers continue development of new products to help utilities find the most practical, economical solutions to the growing pressures for underground distribution.

By **R. C. KIRK**, Vice President
Research and Engineering, Line Material Industries

As utility men know, there are growing pressures in many areas, to install distribution lines underground. These pressures come from the public, from subdividers and builders, and from communities.

New L-M Developments Help Cut Cost

Recognizing that these pressures are continually increasing, Line Material over three years ago, began working with utilities to produce equipment that would economically and practically solve this problem. The result is additional equipment from L-M which offers substantial reductions in underground distribution system costs, namely:

1 The Pad-Mount Transformer—a distribution transformer with a self-contained enclosure for terminals, switching and protective equipment that can be mounted on a ground-level pad or on a rooftop.

2 The Transclosure—a ventilated steel enclosure, also mounted on a ground-level pad, for pole-type distribution transformers, protective and switching equipment, load transfer equipment; can also accommodate service meters and telephone equipment.

3 The Power Pedestal—a stake-mounted pedestal for aboveground connection and termination of underground secondary services and secondary mains.

Underground Distribution Headquarters

Because of our extensive work in this field we logically consider Line Material as "Underground Distribution Headquarters." We would be happy to share our knowledge with you and would appreciate the opportunity of showing how our products can provide a practical and economical solution to your underground problems. Contact your L-M Field Engineer, or write me direct at Line Material Industries, Milwaukee 1, Wisconsin.

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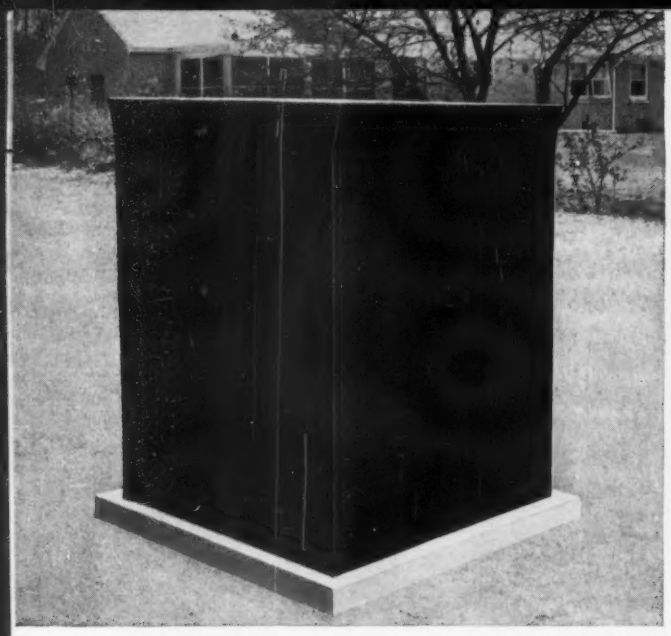
LINE MATERIAL® Industries
McGRAW-EDISON COMPANY
McGRAW EDISON

Underground Distribution Headquarters

DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT



THE L-M TRANSCLOSURE is a convenient, economical bridge between overhead and costly conventional underground. The steel enclosure houses L-M distribution transformers and protective equipment; may be ganged if desired. It is well ventilated and safe from intrusion. The unit is compact and inconspicuous, and in neighborhood service, planting conceals it completely.

THE TRANSCLOSURE, assembled at the job site, being mounted on concrete pad. Conduit and cable have already been installed. Enclosure is completely tamperproof. It is fastened to the anchor bolts on the inside. Removable front and back panels have provisions for padlocking. There is ample room for a standard pole-type transformer, cutouts, lightning arrester, pothead and other equipment.

L-M "Transclosure" Puts Transformers Above Ground for Underground Systems

New L-M designed enclosure provides safe, convenient installation of pole-type distribution transformers, reclosers and other protective equipment. Also convenient for load transfer control systems, and other equipment, for new subdivisions, shopping centers, industrial plants, and highway lighting.

By **C. W. PETERSEN,**
Product Manager,
Line Construction Materials
Line Material Industries

Today every utility is faced with the problem of providing underground service safely, conveniently, and at reasonable cost. Line Material engineers have for years been familiar with the many problems of vault construction, and the type of equipment needed for conventional underground construction.

Extremely Flexible Design

One low-cost answer to the problem is the new L-M Transclosure. The Transclosure is a heavy gauge steel cabinet, specially designed to house L-M Round-Wound pole-type distribution transformers and associated equipment. It is shipped, and stocked disassembled; assembled on the job site. Modular construction permits expanding units to provide for any desired space. The cost of intermediate side panels can be eliminated. When load growth necessitates larger transformers, units may also be expanded vertically, by installing larger side panels and bottom vents.

Safe, Well Ventilated; Rainproof

Vents provide ample ventilation, with baffles to prevent penetration by any object. Sloped roof sheds rain. The unit is completely safe. Removable front and back doors with provisions for padlocking, provide complete and easy accessibility to equipment. With special modification meters may also be internally mounted, with glass windows in the door, for meter reading without opening the cabinet or entering the customer's premises. Telephone equipment may *also* be installed in the Transclosure in a separate compartment with separate access door.

Three Sizes Available

The Transclosure is available in three basic sizes to accommodate a range of standard transformers. Roof, base, and door sections are identical for all three sizes and are interchangeable. With packaged "conversion" units of side panels and lower vents, a smaller unit can be changed to a larger unit.

The cost of the Transclosure is moderate—far less than conventional vault construction, and less than most of the makeshift compromises that have been tried. De-rating of L-M Transformers is not required under all except most severe overload conditions.

Will It Meet Your Problem?

The L-M Transclosure has solved a number of different problems; there are probably many applications not yet conceived. Let us submit detailed data. Ask the L-M Field Engineer for suggestions; or write me for bulletins at Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

LINE MATERIAL® Industries
McGRAW-EDISON COMPANY

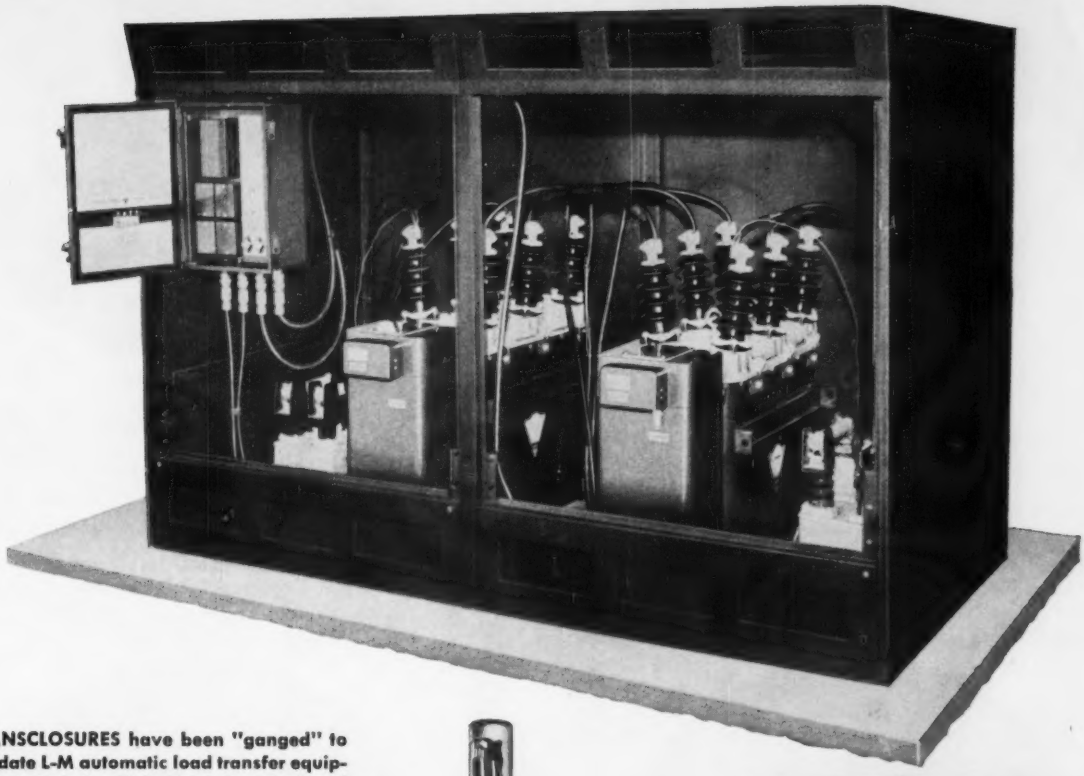
405

Underground Distribution Equipment

DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT

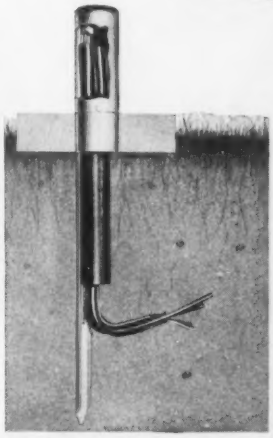
"TRANSCLOSURE" BY L-M

For economical underground distribution



TWO TRANSCLOSURES have been "ganged" to accommodate L-M automatic load transfer equipment, which includes Kyle Type S control and two 400 ampere VR switches. Equipment like this is often used in radio stations, at hospitals and industrial plants and similar locations where assurance of service continuity is vital.

L-M POWER PEDESTAL, for use with Transclosure or Pad-Mount transformer. Provides above-ground connection for underground secondaries. A similar type is available for telephone service. Rainproof, tamperproof. Several styles and sizes. Ask for bulletin.



AVAILABLE IN THREE SIZES

Catalog Numbers	DU8E1	DU8E2	DU8E3
Overall Dimensions—Inches	42 x 42 x 46 high	42 x 42 x 56 high	42 x 42 x 66 high
Max. Transformer Size	5 KV through 25 KVA	5 KV through 100 KVA 15 KV through 25 KVA	15 KV through 100 KVA
Packed Ship. Wt. Ea.—	510 pounds	590 pounds	645 pounds
Effective Venting Area (total vent less screen)	125 Sq. in.	250 Sq. in.	250 Sq. in.

L-M's NEW
PAD-MOUNT TRANSFORMER
A specially designed unit with locked primary and secondary compartments, available in single- and three-phase types, in a variety of sizes. Provides above-ground service for underground distribution.

Compresto®

ALWAYS AN EYE ON QUALITY AT SOUTHERN ELECTRICAL

At each stage in the production of transmission and distribution cables, there are trained, watchful eyes to maintain Southern Electrical's quality-control that produces superior cable for a growing electrical utility industry.

Combine quality products with an unchallenged reputation for fast delivery and you have the formula for the service that Southern Electrical brings to the electrical utility industry. Meeting your needs promptly with the best possible product is the goal that produces that famous SOUTHERN SERVICE THAT EXCELS THE REST . . . SOUTHERN QUALITY MEETING EVERY TEST!

Now Available: "Southern Electrical's Growing Family of Compresto Cables," the all-new brochure that provides the latest data for the use of Compresto Cables.

Southern Electrical Company

OLIN MATHIESON • METALS DIVISION • CHATTANOOGA, TENNESSEE

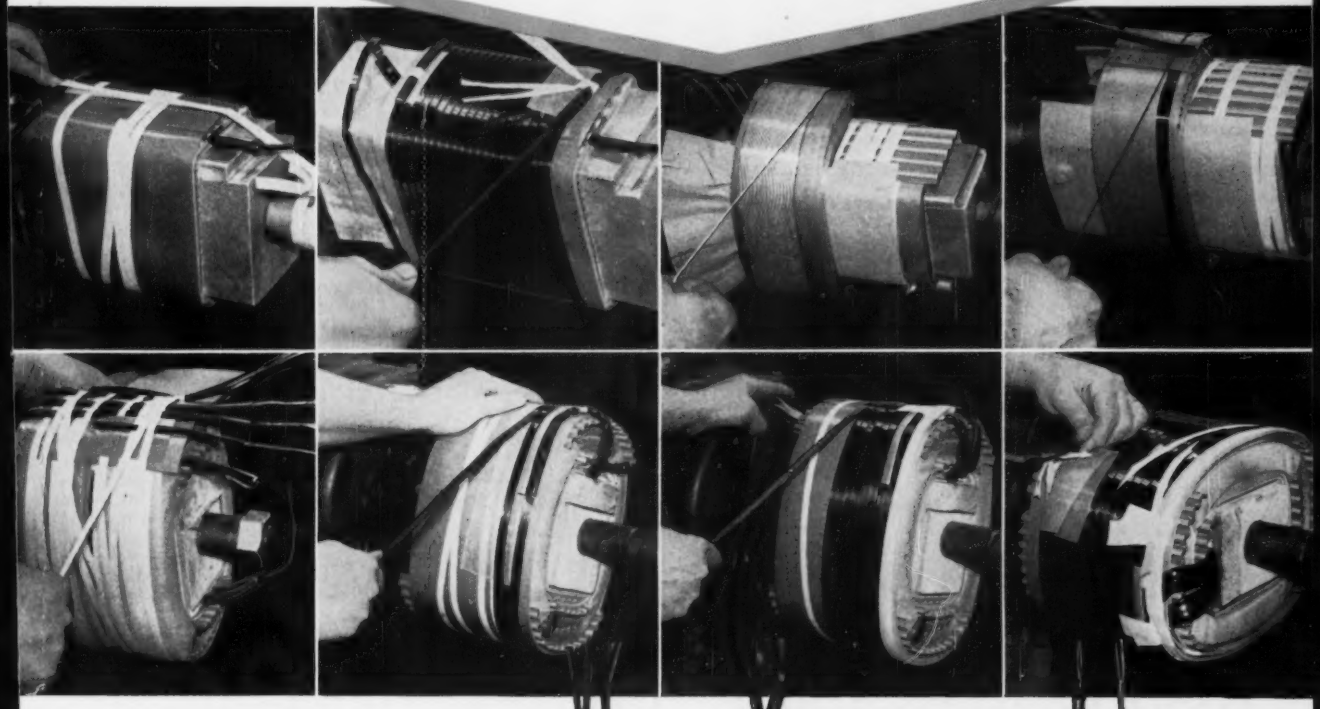
See Edward R. Murrow on "Small World" every Sunday evening, CBS-TV.

OLIN ALUMINUM

MOLONEY DISTRIBUTION TRANSFORMER COILS . . . DESIGNED FOR PERFORMANCE

The coils used in Moloney Distribution Transformers are composed of materials especially selected and carefully tested for this specific application. These materials, used under the supervision of experienced transformer design engineers, result in a mechanically-strong, electrically-efficient coil. One feature of this coil is the low impedance which results in improved voltage regulation and therefore increased revenue and better customer relations. Specify the transformers designed for performance . . . Specify Moloney Transformers . . . All Along The Line.

M333-3



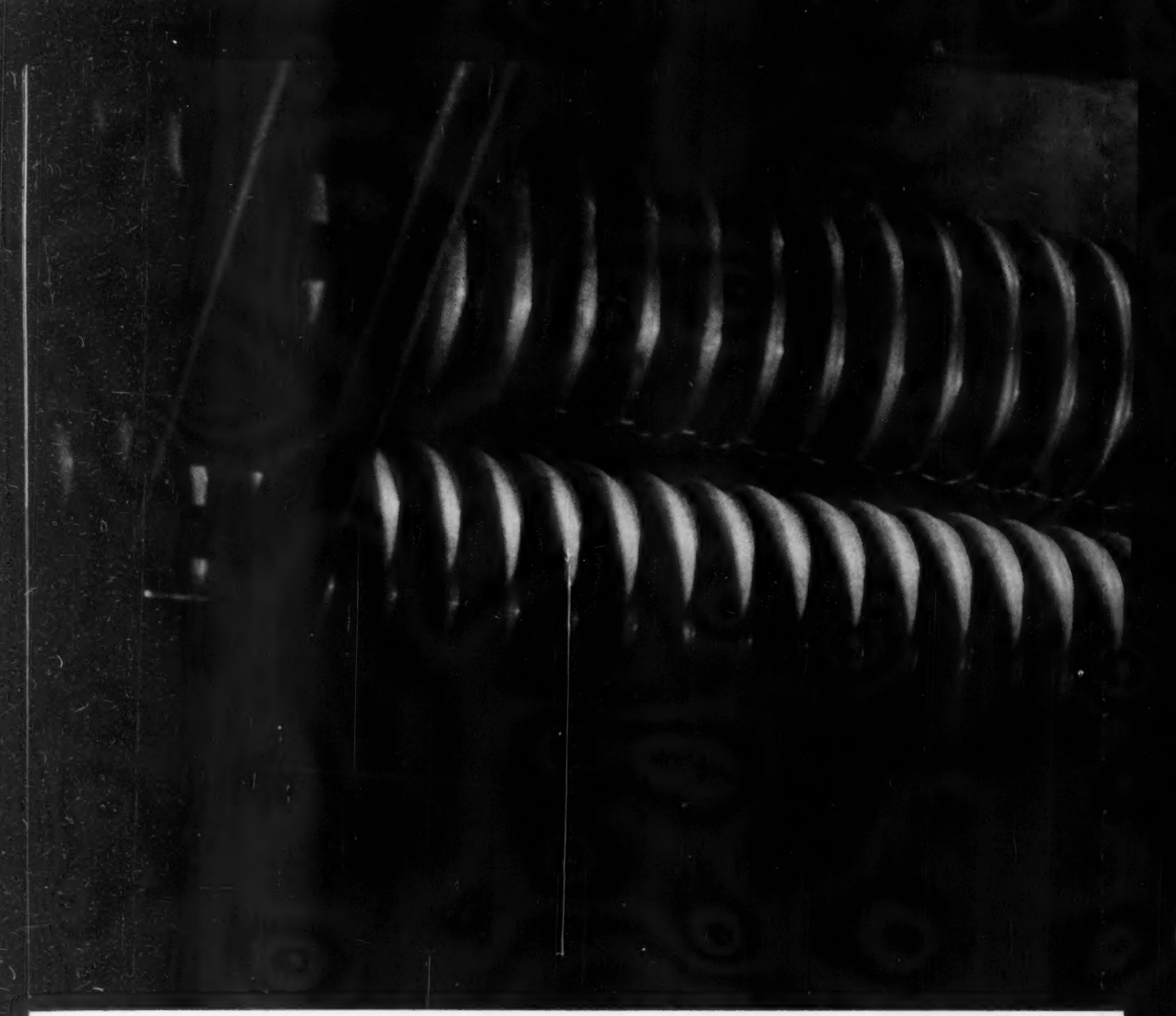
- Turns anchored in place.
- HV winding sectionalized to reduce layer stresses.
- Thermo-setting resin-coated paper used between layers.
- All leads vinyl covered where they are brought through the coil.
- Cooling ducts strategically located.
- LV-HV-LV sequence of coils gives optimum clearance from HV to ground.
- Extra insulation on coil leads, connections and taps.

MOLONEY ELECTRIC COMPANY

Manufacturers of Transformers for Utilities, Industry, and Electronic Applications

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO., AND TORONTO, ONT.

MOLONEY ELECTRIC



Installs like cable . . . protects like conduit!

Conduit-like protection . . . yet it's *flexible!*

And because it's flexible, you can install Rome's interlocked armored cable as easily as most ordinary cables—around corners, machinery, other obstructions. You merely pull it through in long, unbroken runs on low-cost cable-supporting ladders,* or suspend it aerially with cable rings. Where you need to splice, a mechanical joint does the job in a jiffy.

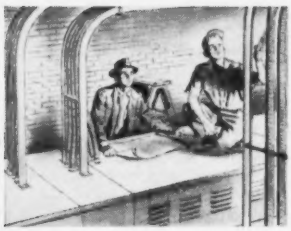
Rugged protection And it's *rugged.* A metallic armor of aluminum alloy, bronze or galvanized steel provides high mechanical protection for your electrical system. If you need exceptional corrosion resistance, you can get it with a thermoplastic (PVC) sheath over the armor.

Increased ampacity Because it approaches a free-air type of installation, Rome's interlocked armored cable has a high current-carrying capacity. Heat is dissipated readily —not trapped as it would be in conduit.

Saves space And you save space—almost one inch less space for each 3/C 500 MCM of interlocked cable than for conduit-type installation. Just one cable ladder* supports a substantial number of interlocked armored cables, takes far less space than multiple-conduit runs.

For heavy-duty service You can use Rome's interlocked armored cable for almost any heavy-duty service application: in power plants, food processing plants, refineries, steel mills, pulp and paper mills, chemical plants. It is widely used for high-voltage primary feeders from power stations to unit substations and for secondary feeders from unit substations to load centers.

Available in three-conductor construction, rated at 600, 5000 to 15,000 volts. You can get all the details in Bulletin RCP 730. Clip and mail the coupon for your copy.



Easy to service You can make inspections easily—cables are fully accessible on open cable-supporting ladders,* or suspended on cable rings. In case of accidental damage, you merely cut out a short section and splice. No need to pull out the cable as you do with conduit.

Easy to add new circuits In the event of changes in plant layout, the simplicity of these systems makes it easy to add new circuits to existing runs. Systems can also be easily and quickly dismantled and reinstalled elsewhere—with a minimum of scrap.

Cable-supporting ladders (either galvanized or aluminum) are manufactured by T. J. Cope Division, Rome Cable Corporation, Collegeville, Pennsylvania.

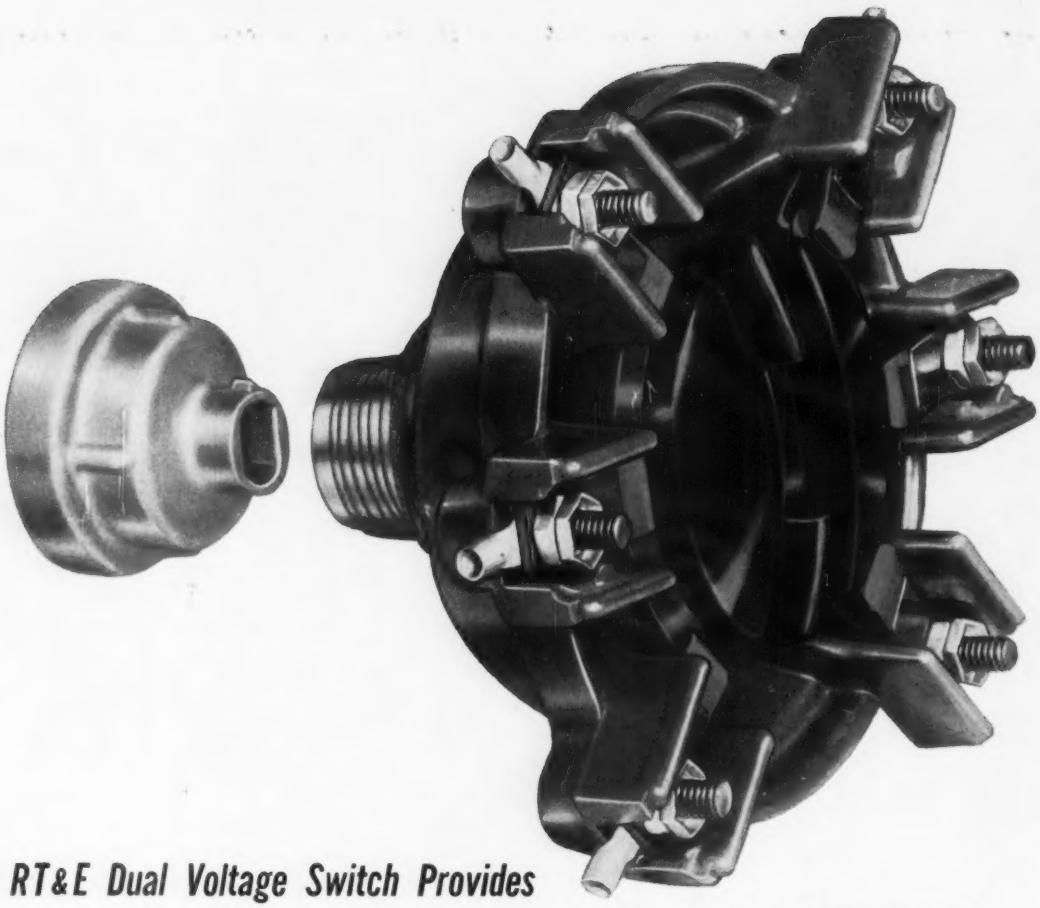
Insulation The butyl compound insulation (Rozone A) used on Rome's interlocked armored cable is heat-, moisture- and ozone-resistant. Cable can be installed out of doors or in other damp locations safely. Metallic armor provides exceptional mechanical protection.

ROME CABLE
DIVISION OF **ALCOA**
Department 11, Rome, New York

☐ Please send me more information on the above.

Name .....
Title .....
Company .....
Street .....
City ..... Zone ..... State .....

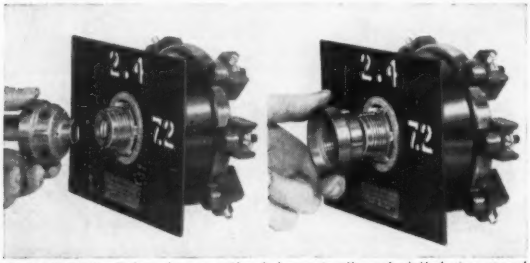
NATIONAL ELECTRICAL WEEK
FEB. 7-13, 1960



New RT&E Dual Voltage Switch Provides

FOOLPROOF OPERATION

You cannot operate this improved RT&E dual voltage switch incorrectly. It can be moved only with the keyed handle provided, and the switch must be correctly positioned before the handle can be removed. This successor to the industry's first externally-operated dual voltage switch demonstrates further proof of RT&E's four years of dual voltage experience. Improvements include a new body of shatterproof polyester glass, dimensionally, chemically, and thermally stable, and new spring-loaded contacts that assure constant positive contact pressure. In addition, this single switch handles both even and odd multiple voltages. Plan to uprate your system now, with RT&E dual voltage equipment — transformers with more built-in experience.



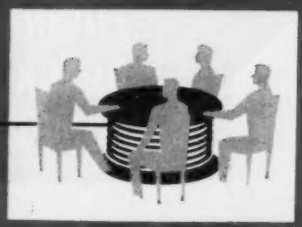
SAFE! Unique keying action between handle and slotted ring around shaft assures positive positioning before handle can be removed.

RT&E CORPORATION
WAUKESHA, WISCONSIN
PORTLAND, OREGON

ENGINEERING TALENT CONCENTRATED ON ONE IDEA
A BETTER TRANSFORMER

KK

WIRE AND CABLE ROUND TABLE



You have asked . . .

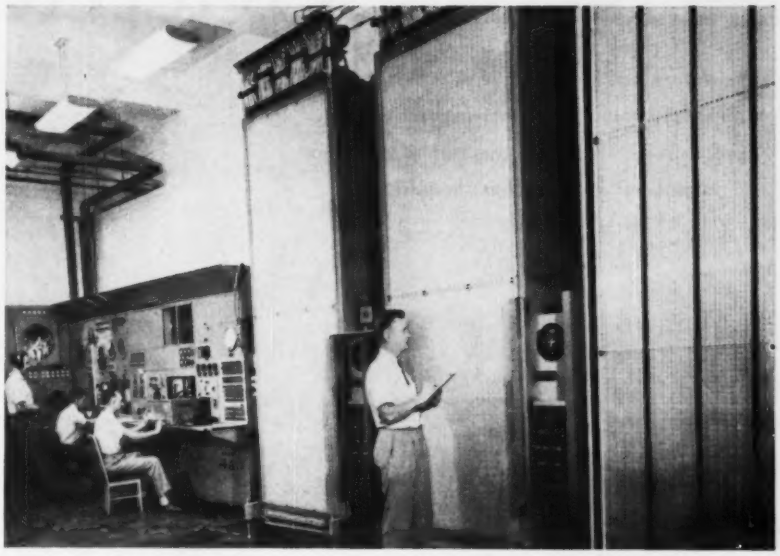
Q. How are environmental-stress-crack ratings of polyethylene determined? And is there a standard test?

A. There is no universally accepted test for environmental-stress cracking (cracking that occurs when PE is subjected to mechanical stress in the presence of an unfavorable chemical environment). However, one test has become nearly standard for defining this phenomenon.

In this test, a ⅛"x½"x1½" sample of polyethylene is slit to a depth of 0.20" with a razor blade. The sample is then bent with the slit on the outside, and the piece is inserted into a test tube containing a reagent. If the grade of PE being tested is susceptible to environmental-stress cracking, the time required for the cracks to appear is noted. Any cracks signify failure. Usually, many samples are tested at once, and the figures reported show the results as "F50 hours" (time to failure of 50% of the samples).

Fortunately for the practical purposes of the user of wire and cable, there is not a confusing myriad of reagents which must be catalogued, nor a wide range of PE's. All polyethylenes are either the high molecular weight, stress-crack-resistant type, or the common insulating type, which is far less resistant to environmental-stress cracking. The former, though somewhat more expensive, is recommended where there is chance of any chemical reagent being present. The latter is suggested only when first costs are unusually important or where the insulation will be protected from chemicals.

Du Pont does not manufacture wire and cable, but supplies thermoplastic resins for insulation and jacketing.



Thousands of feet of pneumatic tubing accurately transfer vital test data to one central control room at Air Force research and development center.

Pneumatic tubing of Du Pont ALATHON® saves up to 90% of installation costs

At the USAF's Arnold Engineering Development Center at Tullahoma, Tennessee, pneumatic tubing extruded from Du Pont ALATHON 3C polyethylene resin is relied upon to carry sensitive test results from giant wind tunnels to a central control room for recording. This tubing, sold by The Imperial Brass Mfg. Co., Chicago, under the name Poly-Flo, was selected by the Air Force for many reasons—among them low initial cost and low installation cost.

Pneumatic tubing of ALATHON . . . like Imperial's Poly-Flo . . . is far less expensive than the metal it replaces. However, the dramatic savings are in installation. No flaring tools, wrenches or special tighteners are required for installation. Only a pocketknife is needed to cut the tubing to the proper length, and finger-tightening of the Imperial Poly-Flo fittings assures a foolproof connection.

Thus it is possible to save as much as 90% of installation costs. In one recent documented industrial installation, costs were reduced from $2.10 per foot for installed metal tubing to only 14⅓¢ per foot for Imperial Poly-Flo tubing. This tubing is impervious to almost all chemicals and solvents, creating extra savings.

Another important point with pressure-sensing instruments is that tubing made from ALATHON does not transmit vibration as some metal tubes will. And the effective temperature range for the use of this pneumatic tubing is -90° to +175°F.

Why not find out how pneumatic tubing made from Du Pont ALATHON polyethylene resin can save you money in your signal and control applications? Contact The Imperial Brass Mfg. Co., or write: E. I. du Pont de Nemours & Co. (Inc.), Dept., M-125, Room 2507A Nemours Bldg., Wilmington 98, Delaware.

POLYCHEMICALS DEPARTMENT

DU PONT

REG. U.S. PAT. OFF.

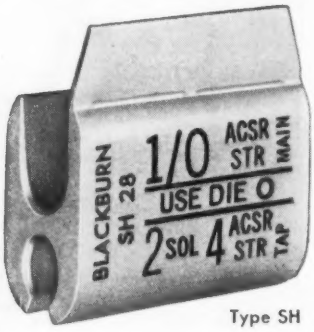
Better Things for Better Living . . . *through Chemistry*

ALATHON® POLYETHYLENE RESINS | **RULAN®** FLAME-RETARDANT PLASTICS | **ZYTEL®** NYLON RESINS

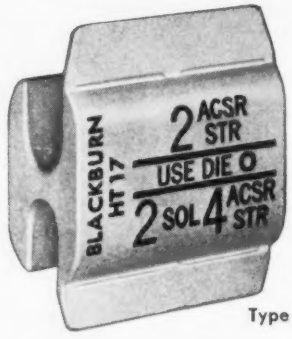
ENGINEERED INTO
BLACKBURN'S
COMPRESSION CONNECTORS

High Conductivity-

Blackburn has engineered all compression connectors shown to fit your present tooling program—and added advantages to meet engineers' and linemen's requirements.



Type SH



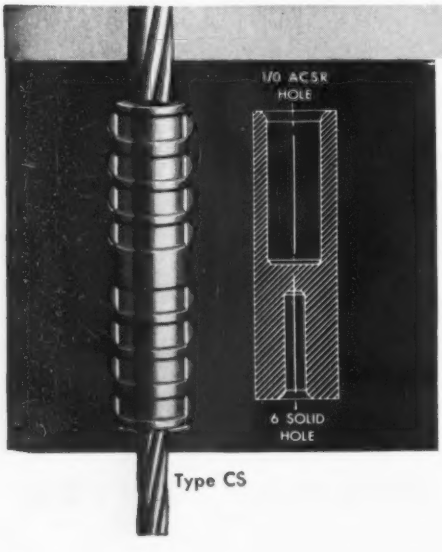
Type HT

Type HT Prefilled

Type SH Prefilled

Standardization now possible with Blackburn "H" frame connectors

- **Designed to fit the tools you already have for applying "H" frame type connectors.**
- **Full length tab completely seals out moisture, easiest to bend and install!**
- **Shot blasted to improve conductivity and retard corrosion.**
- **Prefilled with Blackburn's superior oxide-inhibiting compound, Contax, in easy-tear tab vacuum package.**
- **Color fast, large, easy-to-read lettering.**
- **Type HT is reversible, both grooves "open". For large aluminum tap to smaller copper main. Also used for dead ending.**



Type CS

You get higher conductivity with Blackburn service entrance sleeves

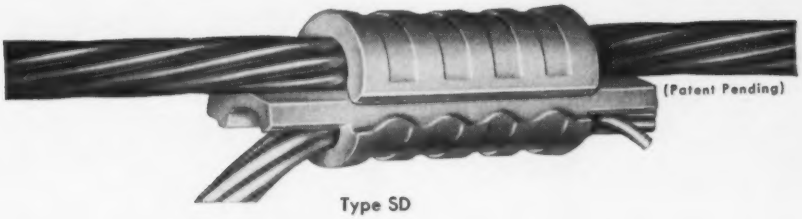
Blackburn—and Blackburn *alone*—provides greater contact area where needed, to assure greater conductivity. This is accomplished by increasing hole depth as the diameter of the conductor is increased, thereby providing more contact area for the conductors being connected.

The Color Coding is *printed* for quick, positive identification.

The sleeves' ends are sealed with Aluminum Sensitized Tape, which is easy to puncture . . . and, if a particle of the seal is pushed into the chamber, the particle is conductive.

Contax, Blackburn's superior oxide-inhibiting compound, is already in these sleeves *in measured amount.* Won't squirt out on glove or in face. And the solid center stop in a Blackburn Sleeve assures proper distribution of the inhibitor around the conductors. Designed for tooling you have.

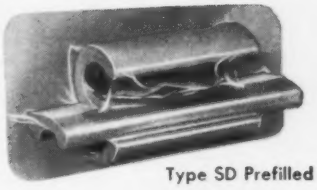
High "Use-Ability"



Type SD

Exclusive drip-guard separator in Blackburn 6-frame tap connector gives *extra* protection to bi-metallic connections

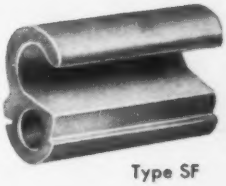
- Spacer allows SD Connector to be used for bi-metal connections with the tools you already have for "C" Frame type connectors.
- An economical substitute for "L" taps, since extended drip guard gives extra insurance against corrosion products bridging the bi-metallic gap.
- A true *two-handed* connector, very adaptable for hot line work.
- Shot blasted for highest conductivity and corrosion resistance.
- Prefilled with Blackburn's Contax and vacuum packed for insurance against corrosion.



Type SD Prefilled

Type SF

- Recommended for aluminum to aluminum.
- Spacer gives better protection against strand breakage.
- Can be installed with same tooling used for Type SD.
- Prefilled with Blackburn's Contax and vacuum packed for insurance against corrosion.



Type SF

Type TR

Blackburn neutral repair sleeves save dollars on triplex services

- Salvage short lengths of pre-assembled service drop cable with Blackburn Sleeves.
- Designed for and tested with the tools you already have.
- Extra length engineered for neutral pullout values in keeping with dead end devices.

See JB Catalog 858 for Tooling INFORMATION

LIVE BETTER ELECTRICALLY

JASPER BLACKBURN CORPORATION

1525 Woodson Rd., St. Louis 14, Mo. • WYdown 3-9430

The Kariba Dam is being built on the Zambesi River to provide hydro-electric power for Central Africa.

Transmission equipment for this project is being manufactured by BICC. Altogether orders for this company total some ten million dollars and include a specially designed 330,000 volt single-conductor oil-filled cable which will connect the underground power house to the overhead transmission lines. This will be highest voltage cable ever installed in Africa.

the 330,000 volt Kariba Cable

the highest voltage in Africa

experience

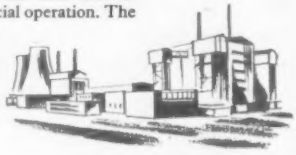
keeps BICC *in the lead*

D.S.O. FOR ECONOMY

The Ductless, Shaped-conductor Oil-filled cable is BICC's latest development in 33kV transmission. Dispensing with fillers and built-in ducts, it costs less than a conventional cable of equal duty.

CABLES FOR THE FIRST NUCLEAR POWER STATION

BICC supplied cables and accessories for Calder Hall, England, the first nuclear power station in commercial operation. The cables included specially designed types resistant to intense radiation and heat, for operating the fuel charging and discharging grabs.



THE FIRST I.P. CABLES IN SOUTH AMERICA

In face of fierce international competition BICC 69kV Impregnated Pressure Cables were selected for power transmission in and around fast-growing Porto Alegre, Brazil.

How do you learn about electric cables?

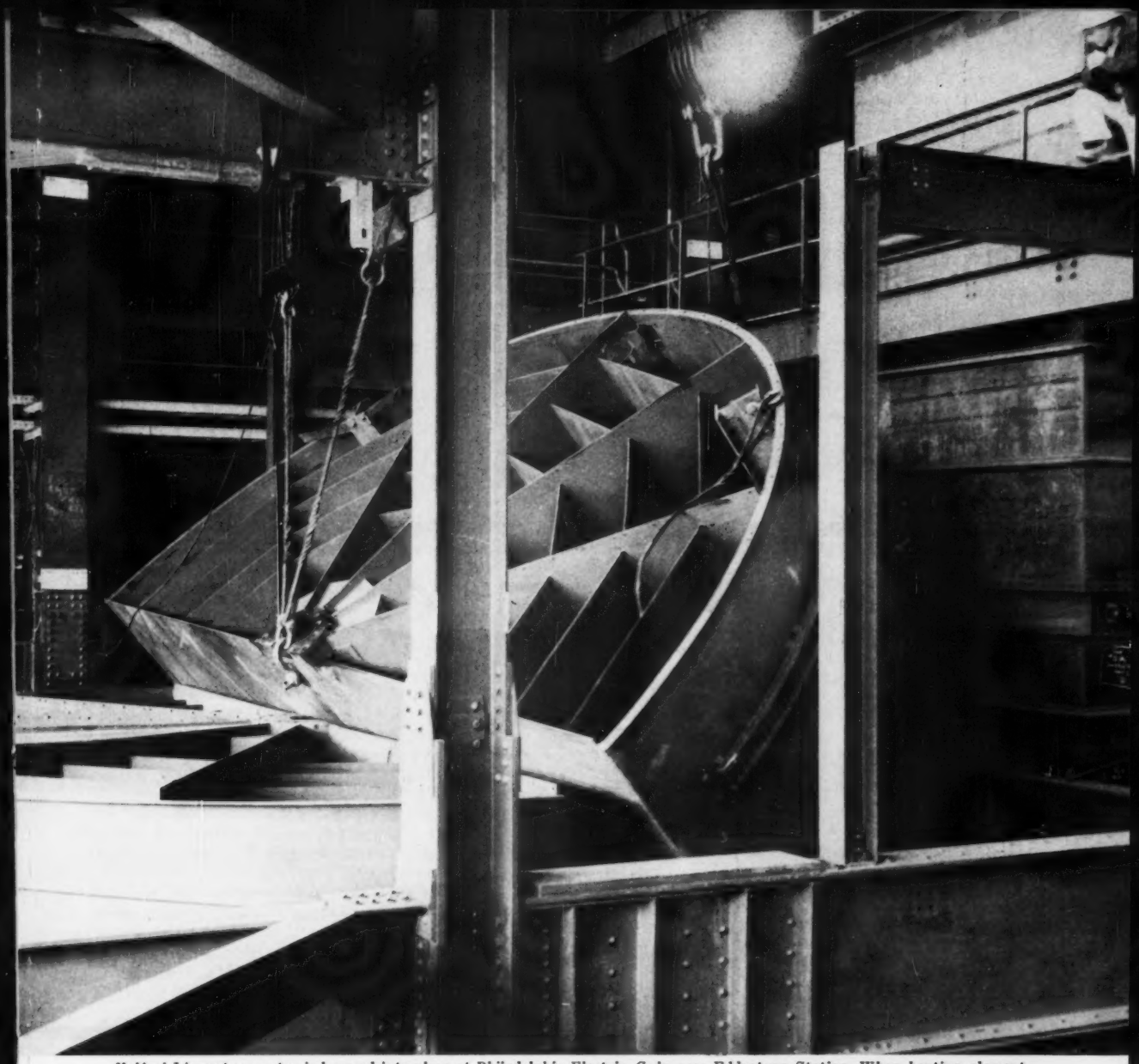
By making them, testing them, installing them, studying them in operation, finding new materials and better designs, and then starting all over again. Years of doing this for every type of electric cable and accessory — that's where BICC's experience came from. Here are some of the results.

BICC

the World's largest cablemakers

BRITISH INSULATED CALLENDER'S CABLES LIMITED

Technical Representative in U.S.A., Arthur F. Coventry, 11 West 42nd Street, Suite 442, New York 36, N.Y.



Half of Ljungstrom rotor is lowered into place at Philadelphia Electric Co.'s new Eddystone Station. When heating element baskets are fitted into the rotor chambers, this unit will provide 201,100 sq. feet of heat transfer surface and will weigh about 535,000 lbs. It will be one of four air preheaters serving a 325,000 KW unit. Two such boiler units are presently being installed.

SAFEGUARDING EDDYSTONE'S **NEW LJUNGSTROMS®** **—LIFETIME AIR PREHEATER SERVICE**

Dependability is standard equipment in Philadelphia Electric Co.'s new Ljungstroms. Each unit is protected by Lifetime Air Preheater Service. That means that *throughout the life of each unit,* Air Preheater engineers make regular calls to inspect the Ljungstroms and keep them in top operating condition.

Air Preheater also shows lively, consistent interest in their *factory* service to customers. For example, when a midwest customer recently ordered emergency replacement elements, Air Preheater's traffic department investigated the cost, speed and control of all commercial shipping methods. In the circumstances, regular trucking would take too long, rail delivery was impractical, other methods prohibitively expensive.

So Air Preheater asked for authorization to ship the replacement elements aboard one of their own trucks. The result: the elements arrived a week in advance of the hoped-for date – and, thanks to Air Preheater's efforts, the customer made significant savings on transportation costs.

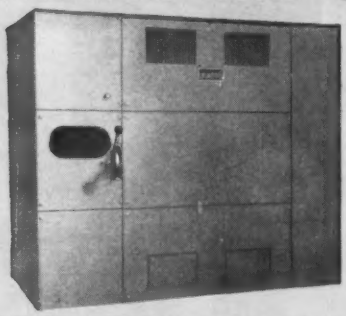
In addition to regular field service and fast, competent factory service, Air Preheater offers you over 35 years of experience in solving boiler and preheater problems. These reasons help explain why 19 of the 20 most efficient power stations in the U.S. are Ljungstrom-equipped.

THE AIR PREHEATER CORPORATION

60 East 42nd Street, New York 17, N. Y.

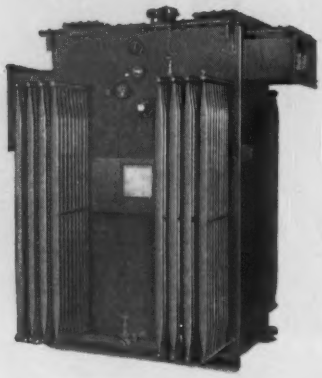
WAGNER UNIT SUBSTATION TRANSFORMERS

112½ to 2000 Kva—three phase, 60 cycles, 15 KV and below



VENTILATED DRY-TYPE—For indoor installation in reasonably dry, dust-free, well ventilated locations. Light in weight, ideal for multi-story buildings. No fireproof vaults required. Insulated for 80°C temperature rise.

for your plant's electrical system...



OIL-FILLED—Generally installed outdoors. Can be used indoors in fireproof vaults. Outdoor transformers can be connected to indoor switchgear using weather-proof bus-duct. 55°C rise, self-cooled or forced-air cooled.

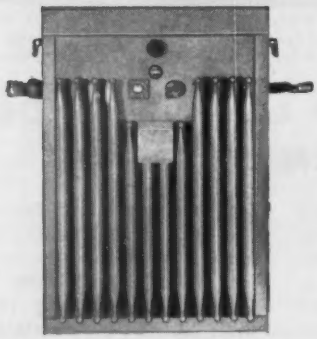
SELECT WAGNER

There's a complete line of Wagner Industrial Transformers. One or more of them will fit your specific needs whether you're planning a new plant distribution system, modernizing your present one, or adding to its capacity to meet increasing demands for power. So, select and specify Wagner Transformers. They'll give you long, dependable service because:

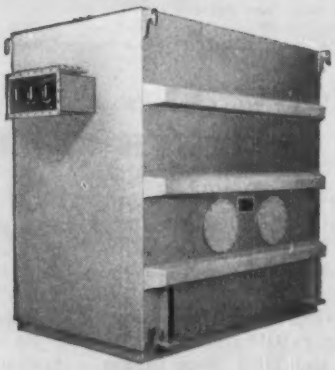
All Wagner Industrial Transformers are liberally designed, sturdily constructed, thoroughly tested, and able to meet the heaviest industrial demands. You get continuous, dependable power for years.

For your main plant substation, Wagner Liquid-Filled Industrial Power Transformers are available in standardized ratings through 10,000 Kva.

Load centers? Wagner makes PREDESIGNED Unit Sub-

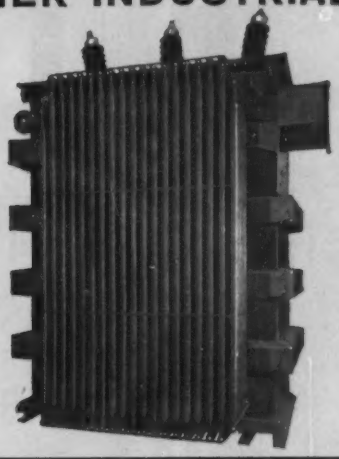


NOFLAMOL—Non-inflammable liquid-filled. For indoor or outdoor installation, especially suited for chemical plants, refineries and similar locations where explosive liquids or gases are present. The close-coupled design fits flush against switchgear enclosures to save space. Throat connected designs are also available. 55°C rise, self-cooled or forced-air cooled.



SEALED DRY-TYPE—Hermetically sealed in welded steel cases to provide positive protection from contamination, fire and explosion hazards. Sealed tank is filled with inert nitrogen. Only maintenance needed is periodic checking of gas pressure. Can be safely installed in any load center.

WAGNER INDUSTRIAL POWER TRANSFORMERS



Oil-filled, for outdoor installations, available through 10,000 Kva, 67 KV and below.

Noflamol, non-inflammable liquid-filled for explosive atmospheres, available through 7,500 Kva, 15 KV and below.

The performance stability of Wagner Industrial Power Transformers is outstanding. Quality is designed and built into these transformers by specialists with years of transformer engineering and production experience. Highest quality materials... carefully controlled production methods... constant inspections and tests make sure these transformers give in-service performance that means better service for your system.

INDUSTRIAL TRANSFORMERS

station Transformers to meet your particular requirements. Furnished with suitable incoming line sections, these transformers will save you time and job engineering costs. And, you can specify the secondary switchgear you prefer.

Wagner Dry-Type Distribution Transformers are an economical choice for plant areas requiring 120/240 volts, single-phase or 208Y/120 volts three-phase.

Over 65 years of constant research and development has made Wagner a leader in transformer design . . . made the name Wagner one of the foremost in power planning. For expert advice on your present and future plant transformer needs, call or write the Wagner branch near you.

get economical, dependable, power packages!

Wagner Electric Corporation
6456 PLYMOUTH AVE., ST. LOUIS 33, MO., U. S. A.

WAGNER DRY-TYPE DISTRIBUTION TRANSFORMERS

Single-phase 1 to 100 Kva—Three-phase 3 to 300 Kva—600 volts and below.

These dry-type distribution transformers have a low sound level, are compact and light in weight. They meet all safety requirements for indoor installation. They are economical to maintain... have no liquids, valves, gaskets or gauges.

Type AE, single-phase, 1 through 50 Kva, and Type AP, three-phase, 3 through 30 Kva, can be installed indoors or out. Larger ratings for indoor installations only. Ratings through 10 Kva single-phase are filled with an epoxy compound... operate quiet as a whisper... perfect for areas where noise would be a nuisance. They, and three-phase units through 30 Kva are designed for wall mounting... other ratings for floor or platform mountings.

Available for high voltages of 120 x 240, 240 x 480, 480 and 600 volts to 120/240 volts single-phase, and 480 and 600 volts to 208Y/120 volts three-phase.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

WT60-3

BARTLETT

More than 13 years ago Bartlett successfully pioneered the use of the helicopter for shade tree spraying—an operation that was to lead the way, a few years later, to a new efficient method of control of woody plants along utility rights-of-way.

At first, difficult terrains presented unusual problems but gradually through research and experience, new equipment was developed and new herbicides and techniques perfected to overcome them. Today, Bartlett research in this important field is carried on continuously through college fellowships and at the Bartlett Research Laboratories.

If your right-of-way clearance, line trimming, brush control or tree survey requirements present a problem, we invite you to share our years of experience. This service is now available from Maine to Florida, and west to Illinois and Alabama.

The Bartlett Way

BARTLETT TREE EXPERTS

Home Office, 2770 Summer Street, Stamford, Conn.
Research Laboratories and Experimental Grounds, Stamford, Conn.
Bartless School of Tree Surgery, Stamford, Conn.

CRAWFORD STATION COMMONWEALTH EDISON COMPANY *482,500 kw—4 Units*

Power in Illinois. . .

Chicagoland's Commonwealth Edison Company is one of the nation's foremost electric utilities. The company's Crawford Station was the largest steam electric plant in existence when it was completed in 1928. Its turbine-generators were the largest machines manufactured up to that time.

Now, major design developments will permit doubling the capacity of the station within the framework of the existing plant. The first step in the up-dating has already been taken and the second step is in process. When this is completed this historic plant will again rank among America's major central stations. Along with other major installations, Crawford's rebuilding will provide the Commonwealth Edison system a total net capacity of over 5.6 million kw by the end of 1962.

FULL COLOR BROCHURE outlining the scope of Sargent & Lundy services will be sent on request.

SARGENT & LUNDY
ENGINEERS

140 SOUTH DEARBORN STREET, CHICAGO 3, ILLINOIS

ONLY CRESCENT OFFERS THIS COMPLETE LINE!
Crescent—2 sizes. 15" and 18". Black finish.
Crescent—5 sizes. 4" to 12". Black finish.
Crestolock—3 sizes. 8", 10" and 12". Chrome finish.
Crestoloy—3 sizes. 15", 18" and 24". Chrome finish.
Crestoloy—5 sizes. 4" to 12". Chrome finish.
Crestoloy—4 sizes. 4-6" to 10-12". Chrome finish.

NONE BETTER ANYWHERE!

CRESCENT and CRESTOLOY Wrenches are made by the originators of the 22½° adjustable wrench. They have been widely copied but never equalled for design, balance, quality and all-around performance. The buyer who wants top value in tools insists on CRESCENT.

Sold by hardware dealers and industrial distributors everywhere.

CRESCENT TOOLS
Give Wings to Work
Sign of the Artisan
Symbol of Excellence

Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

ELKONITE® CONTACTS
put the "extra" in circuit breaker service

To make sure that breakers in secondary distribution transformers will give the thorough dependability you expect, it pays to specify Elkonite contacts.

Elkonite materials are the result of *contact technology in depth*. Through Mallory-pioneered powder metallurgy techniques, they combine the heat resistance of refractory materials with the conductivity metals. Our engineers work with apparatus designers to select the exact qualities required for each application . . . hardness, mechanical strength, arc erosion resistance, and minimum heating. Then, in our manufacturing plant, advanced processing techniques control all phases of manufacture to assure adherence to rigid standards.

That's why there's a difference in Elkonite contacts. And there's a difference in the service you get from equipment that uses them. Don't settle for less.

From generator to user,
Mallory contacts serve the nation's utilities . . .

Mallory Metallurgical Co., Indianapolis 6, Ind.
a division of

P.R. MALLORY & CO Inc.
MALLORY

TODAY'S BEST BUY

Install Copperweld Type M Guy Strand on your lines. It's a low-cost, money-saving way to rid yourself, once and for all, of the trouble and expense that result when guys weaken or fail because they haven't got what it takes to resist corrosion.

Copperweld Type M Strand resists corrosion. Each wire is permanently protected against rust by a thick copper sheath that is inseparably molten-welded to a high-strength alloy steel core. And because it's molten-welded, the copper will not crack, flake or peel from the steel core.

As a result you pay for only one guy installation. You can put up Type M Guy Strand and forget it because its original strength is permanently maintained. In fact, this non-rusting guy strand will match the long life of modern poles.

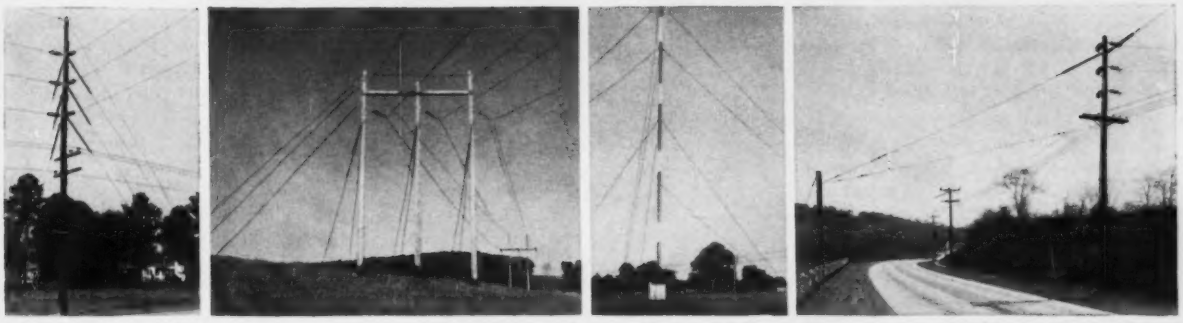
Moreover, Type M Strand goes up fast because it is easy to handle. It can be readily dead-ended by any of the conventional methods. Our Engineering Data Bulletin E.D. 187 gives you the complete story. Send for it today.

PROVED DEPENDABILITY AND LONG LIFE

FOR ALL GUYING PURPOSES . . .

GUY STRAND

requires no maintenance . . . matches pole life



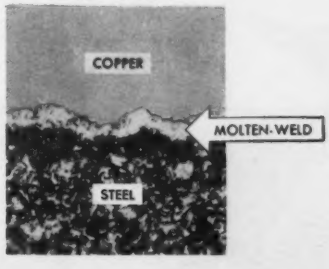
WHATEVER YOU GUY . . . GUY WITH COPPERWELD TYPE M STRAND

Easily installed, Copperweld Type M Strand provides low-cost, safe and permanent guying for overhead lines, towers, poles, antennas, stacks, and similar structures. Put this non-rusting strand up and prove it for yourself.

COPPERWELD STEEL COMPANY
WIRE AND CABLE DIVISION *Glassport, Pa.*
For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

. . . . *assured by the* **MOLTEN-WELD**
-exclusive with Copperweld

Weld area of Copperweld Wire, greatly enlarged



HOW SOUTHERN STATES' BV-33-F CUTOUT CLEARS RESTRICTED OR HIGH FAULTS WITH EQUAL DEPENDABILITY

The complexities of today's distribution systems present a real challenge to the designers of cutouts. Industry requirements call for interrupting capacities up to three times higher than a few years ago. And yet the cutout must clear restricted faults with equal ease and sureness.

Large bore tubes, vented freely at both ends, will clear extremely high faults easily. Small bore tubes, vented at one end, will clear low faults easily. The big problem is to do both.

The Southern States BV-33-F Heavy Duty Cutout clears the complete range of fault currents with equal dependability—without damage to the cutout.

What About Single-Venting?

In single vented cutouts, the rocket effect of the tube, as gases are ejected, must be considered. Some type of shock absorber to cushion the fuse holder, as it tends to thrust upward, must be provided. But so far no practical recoil mechanism has been devised that can fully absorb the violent recoil action. Thus a substantial amount of shock is transmitted to the mounting, insulator, bracket, and cross arm.

As interrupting capacities on single-vented cutouts are increased, bore diameters become critical. If it is large enough to handle high faults, it may provide only borderline protection on restricted faults. Resorting to some extraneous means, such as special types of fuse links, is a dangerous concession to security—as there is no assurance of proper fusing in the field.

What About Controlled Venting?

Providing a small vent hole in the top hardware to permit a limited amount of gas to escape is not the solution either. This practice was dropped by Southern States long ago, when it was found that the hole became enlarged after each operation, endangering proper clearance of low faults.

Here's the Answer

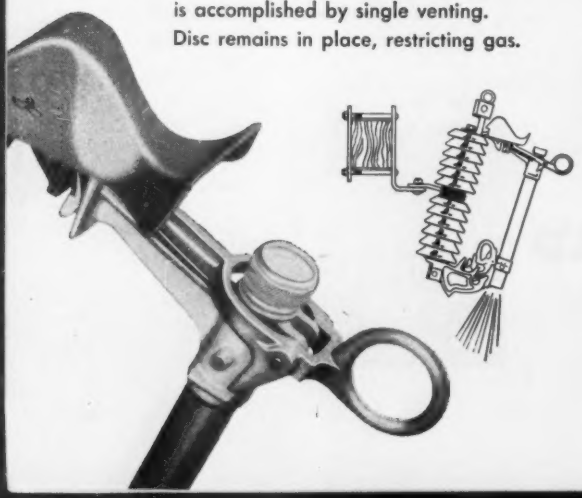
The BV-33-F offers all of the advantages and none of the disadvantages of single-venting or controlled-venting. This is accomplished with an economical expendable cap which confines gases on restricted faults, but allows them to double vent on high faults. Forces inside the tube are equal and opposite. Stress on the mounting is virtually eliminated. The cutout can operate time and time again without loss of efficiency. There is no built-in battering ram—no intricate mechanism, or springs to worry about. And any standard EEI-NEMA fuse link will provide positive operation every time.

Utilities throughout the nation are finding the BV-33-F a practical, workable solution to cutout problems.

Get complete information from your Southern States representative, or write for Bulletin 580C.

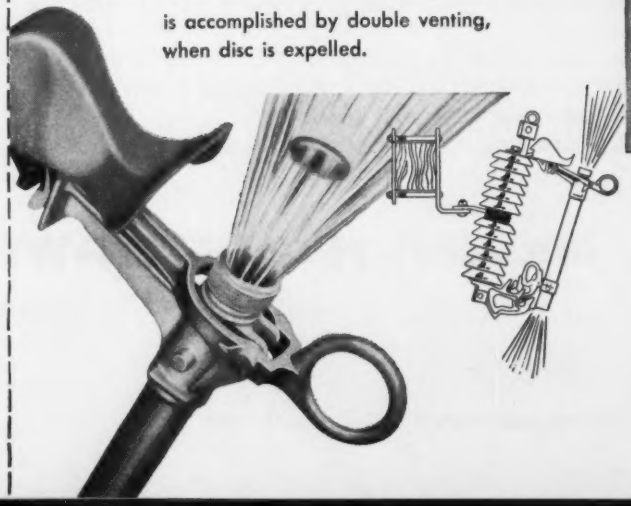
LOW FAULT CLEARANCE

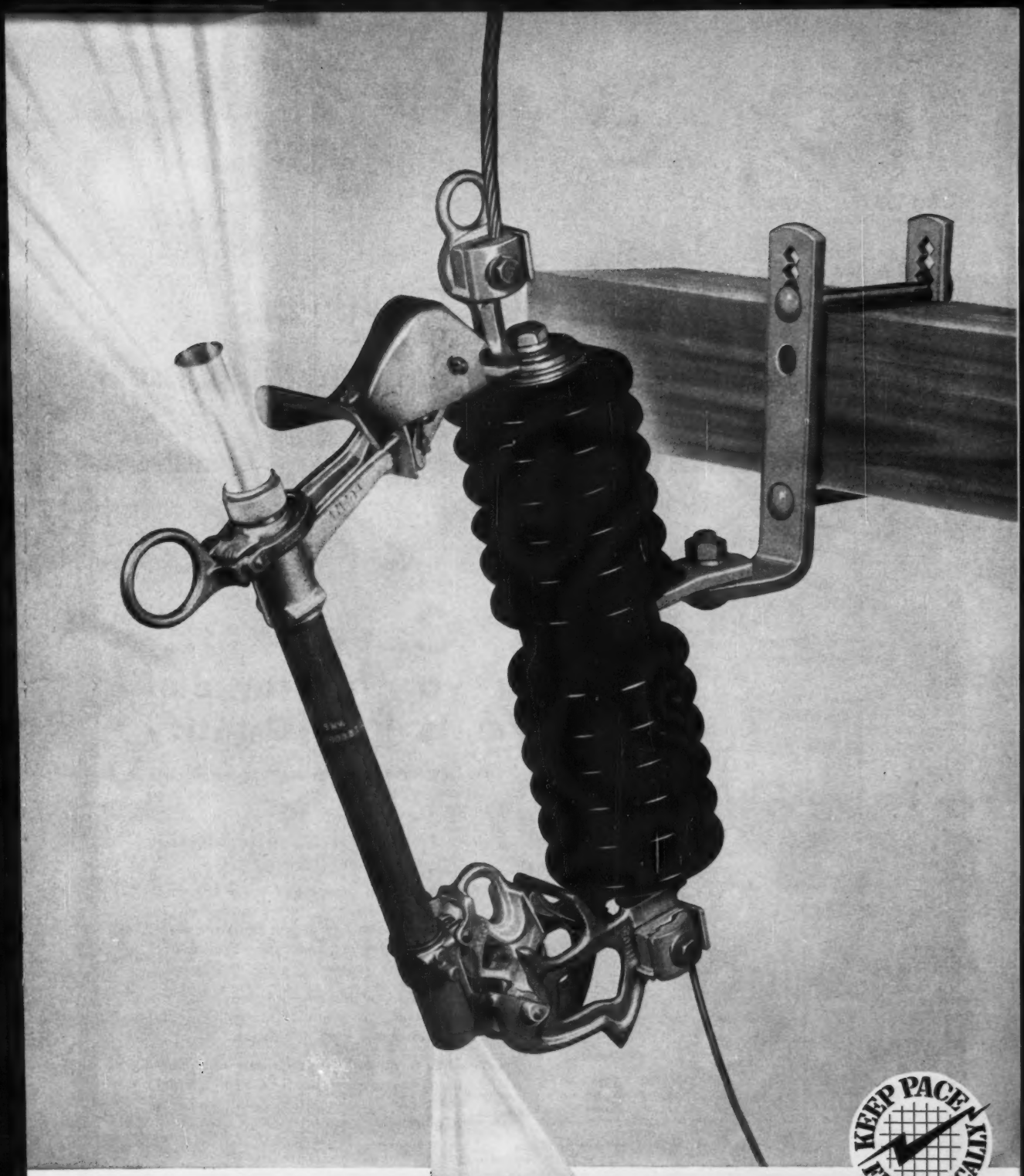
is accomplished by single venting.
Disc remains in place, restricting gas.



HIGH FAULT CLEARANCE

is accomplished by double venting,
when disc is expelled.



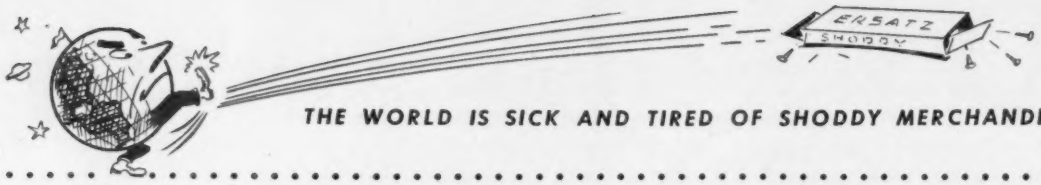


KEEP PACE ELECTRICALLY

SOUTHERN STATES EQUIPMENT CORP.

HAMPTON, GEORGIA

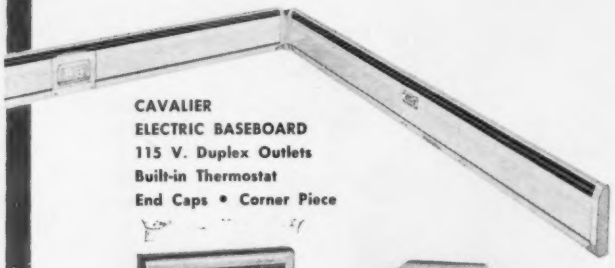
IN CANADA Dominion Cutout Co., Ltd., Toronto



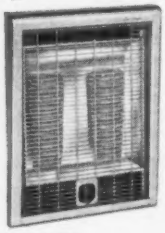
THE WORLD IS SICK AND TIRED OF SHODDY MERCHANDISE

happy, satisfied customers

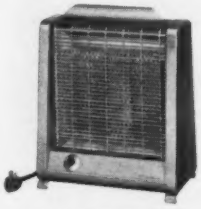
boost your business more than anything else



CAVALIER
ELECTRIC BASEBOARD
115 V. Duplex Outlets
Built-in Thermostat
End Caps • Corner Piece

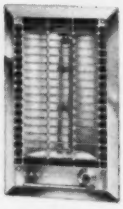


CAVALIER
WALL INSERT
1 to 5 KW



CAVALIER PORTABLE
2, 3, 4 KW

CAVALIER
CABLE
HEAT



CAVALIER BATHROOM
Automatic and
non-automatic
120 and 240 volt

Cavalier...

your assurance of Highest Quality

CAVALIER heating equipment has the genuine quality that sells, pleases customers and eliminates costly service calls.

CAVALIER has a complete line, and backs its products with written guarantees.

CAVALIER heating equipment is soundly engineered, thoroughly tested and built for long life. Although repair parts are rarely needed, they are promptly available at reasonable cost.

CAVALIER keeps within efficient trade channels, and works to assure business-like profits for distributor and contractor.

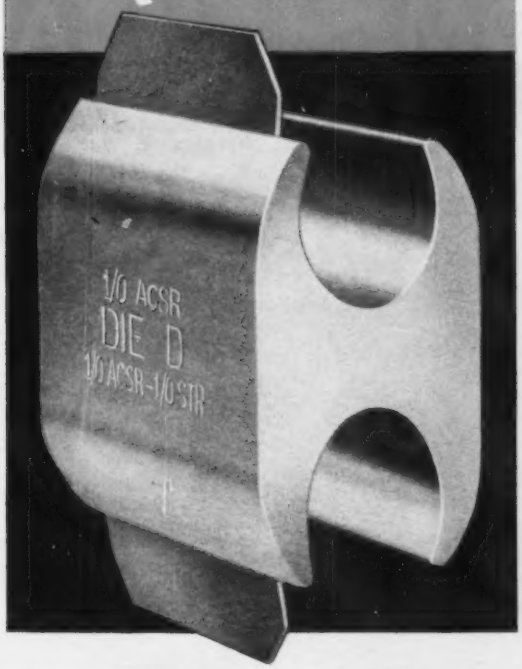
CAVALIER is nationally advertised and backs its highest quality products with complete sales and merchandising helps which are available on request.

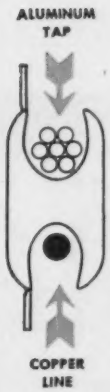
ELECTRIC HEATING DIVISION **CAVALIER CORPORATION** CHATTANOOGA 2, TENNESSEE

OVER 90 YEARS OF QUALITY PRODUCTS

FIRST *in quality construction*
in engineering advances
in safety
in sales making features

new! KEARNEY DOUBLE-TAB SQUEEZON



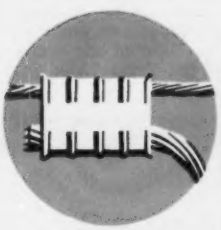


Exclusive Kearney design permits either groove to be used for line or tap. Diagram illustrates Double Tab Squeezon used to make an aluminum "step-up" tap to copper line connection.

NOW! The Easiest Way to Make Both "Step-Up" and "Step-Down" Tap Connections on All Combinations of Copper, Aluminum and ACSR

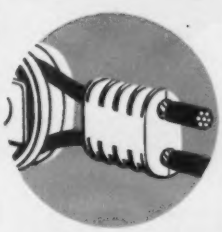
The newest, most versatile Squeezon Compression Connector. Dual, fully open groove design, exclusive with Kearney, eliminates need to thread tap conductor through fitting. Use *either* groove for line or tap . . . make "step-up" or "step-down" tap connections quickly and easily. Double Tab Squeezons speed up deadending, too. Form the loop . . . drop the conductors into the open grooves . . . and compress! On insulated wire, remove only a "Squeezon-length" of insulation!

Available in a range of size combinations for aluminum, copper or ACSR. (Write for Selector Card.) Individually packaged in handy "Snap-Open" boxes; grooves factory-filled with Kearnalex inhibitor and contact aid.



REVERSIBLE
The only compression connector with built-in spacer that makes *BOTH* "step-up" and "step-down" tap connections, from copper to ACSR, aluminum to ACSR, or aluminum to copper.

MASSIVE SPACER
Separates conductors . . . eliminates strand cutting . . . and aids in the prevention of galvanic corrosion between dissimilar conductors.



SECONDARY DEADENDING
Faster, easier. No threading through . . . form the loop, position Squeezon and compress! On insulated wire, strip only enough insulation to make the connection.

"SNAP-OPEN" BOX
Individually packaged. Box snaps apart along perforated line . . . INSTANTLY, CLEANLY . . . even with gloves! No stripping, no peeling.

NO DISTORTION
Squeezon groove jaws completely encircle conductor when compressed . . . provide dependable long-line, full circumference contact without distortion or damage to conductor.

for better construction . . . safer maintenance . . . specify KEARNEY products

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.

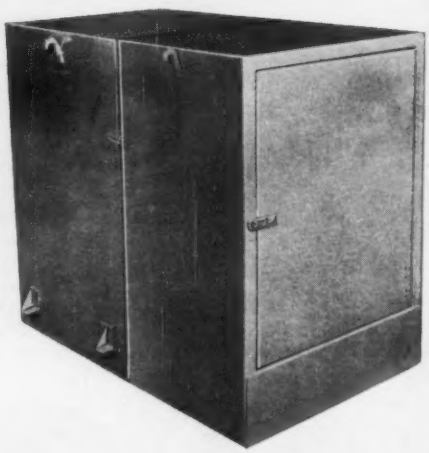
JAMES R. KEARNEY CORPORATION

4224-42 Clayton Avenue, St. Louis 10, Missouri

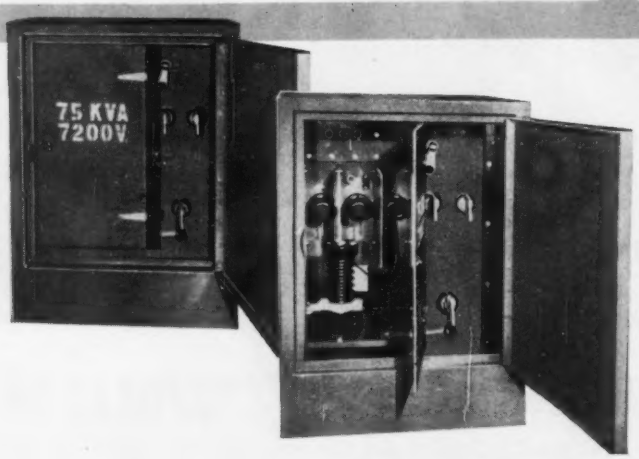
PLANTS AT: ST. LOUIS • FAYETTEVILLE, ARKANSAS • SHENANDOAH & CLARINDA, IOWA • GUELPH, ONTARIO, CANADA

all new...
FROM STANDARD

400 VERSATILE PAD-MOUNTED Standard Transformers have completed two years of field service—more than any other unit of this type. Power and distribution units are available now. They permit all underground wiring, blend into natural surroundings and install in minutes!

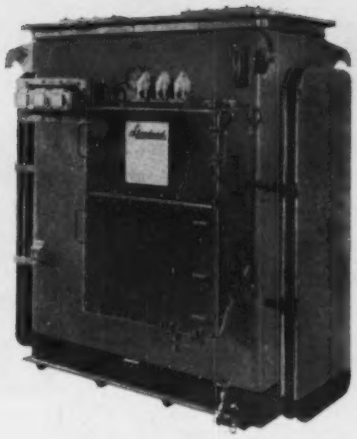


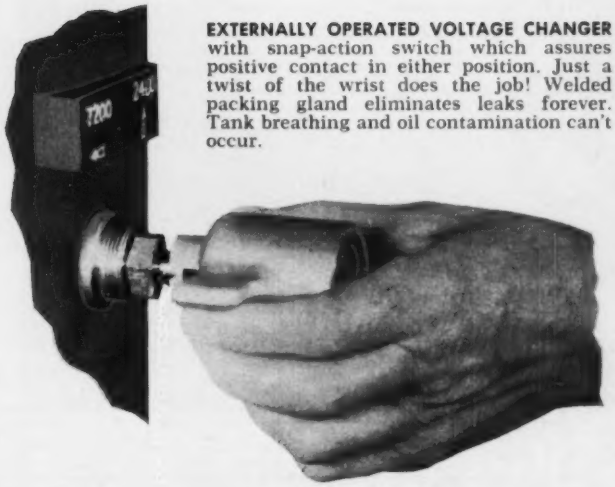
SWA DISTRIBUTION transformers slash copper losses a dramatic 30%, drop impedance to reduce voltage drops and handle greater overloads without excessive heating. New efficiency is sufficient to pay for cost of the transformer! A Standard first. Ask for Bulletin S-401-C.



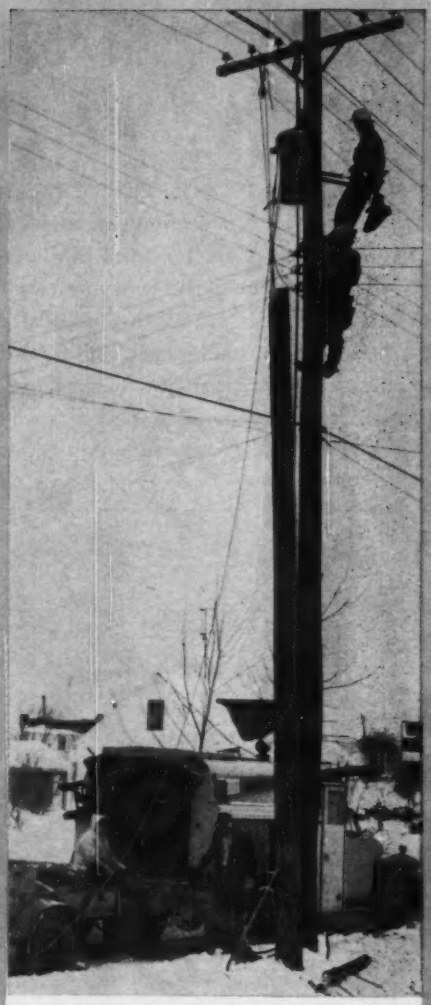
PAD-MOUNTED units can be equipped as you specify. High voltage side is protected by an inside door. Performance features match those of low-loss pole-type SWA units.

PANCAKE RADIATORS permit greater capacity in less space at no loss of efficiency. Maximum cooling, extra copper and steel mean lower losses, better regulation, and increased thermal capacity. It all adds up to increased revenue for you. Ask for Bulletin S-402-A.





EXTERNALLY OPERATED VOLTAGE CHANGER with snap-action switch which assures positive contact in either position. Just a twist of the wrist does the job! Welded packing gland eliminates leaks forever. Tank breathing and oil contamination can't occur.



SWA units stay on the job longer before changeout. They carry more load before they pass the 3% voltage drop danger line. Identical cost-cutting, revenue-building features are now built into ALL Standard transformers.

It's nice to be first and it takes a lot of ingenuity to do it. Standard development engineers have pioneered the advances depicted here in less than a year. Other innovations and advances aimed at decreasing your operating costs will come soon. Watch for them.

Good transformer design and use necessitates matching transformers to specific duty and conditions. As loads increase, efficiencies decrease. But if you're protected with units designed to meet and aid your progress, system growth need not be a problem. Consult your nearby Standard representative. He can help you plan ahead by showing you how the extra capacity built into every Standard unit builds sufficient revenue to amortize the transformer cost.

40 years of concentration on transformer design exclusively

Phone WARREN EXpress 2-1563

Standard Transformer CO.

WARREN, OHIO

"WHEREVER THERE IS POWER"

1959 TOWER TESTS

Show Marley's Plus Performance Value

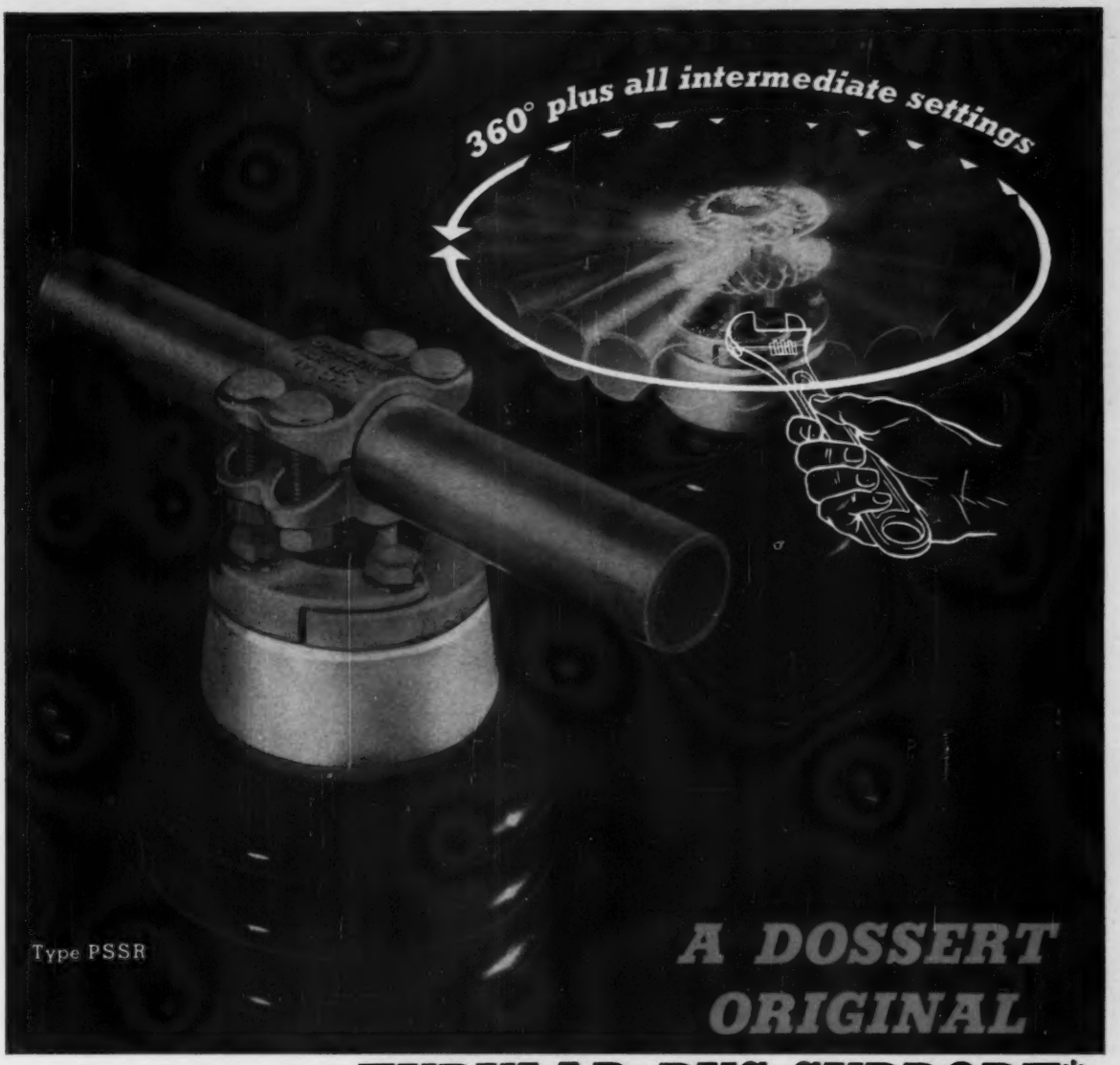
Here is the RECORD OF PERFORMANCE . . . consecutive results of all acceptance tests of Marley industrial Cross-Flow cooling towers made in 1959. This tabulation certifies Marley's ability to rate towers correctly and its single-minded purpose of applying them exactly as rated. Here are factual reports from 27 Marley installations in all parts of the country. Their specified capacities, operating conditions and types of service are as diversified as their geography, but tests uniformly emphasize the fact that these customers received a performance bonus that points up Marley Cross-Flows as vital investments in plant capacity and operating efficiency.

TEST NO.	TYPE OF SERVICE AND LOCATION	SPECIFIED CONDITIONS				TEST RESULT[4]	
		Gallons Per Minute	Hot Water Temp.	Cold Water Temp.	Wet Bulb Temp.	Degrees Cold Water Temp.[5]	Percent Capacity
1[1]	Generating Station—Mid-Atlantic	220,000	97°	78°	70°	+0.35°	+ 3.5%
2	Petroleum Refinery—Gulf Coast	3,500	95°	83°	70°	+ .47°	+ 4.0%
3	Generating Station—Southern	20,000	100°	85°	78°	+ .19°	+ 1.9%
4	Generating Station—Rocky Mtns.	89,300	95°	82°	60°	+1.88°	+ 9.75%
5[2]	Generating Station—S. Atlantic	75,000	113°	90°	74°	+ .20°	+ 1.25%
6	Petroleum Refinery—Gulf Coast	8,600	105.8°	87°	82°	+ .45°	+ 5.8%
7	Appliance Mfg. Plant—E. Central	7,750	95°	85°	78°	+ .40°	+ 5.00%
8[2]	Petroleum Refinery—Gulf Coast	45,000	112°	89°	82.5°	+ .72°	+ 6.65%
9	Generating Station—Mid-Central	62,400	107.5°	90°	76°	+1.10°	+ 7.3%
10	Petroleum Refinery—N. Atlantic	12,900	115°	85°	78°	±0.00°	± 0.0%
11[2]	Meat Packing Plant—North Central	6,000	105°	85°	75°	+ .60°	+ 5.2%
12	Jet Engine Plant—South Atlantic	20,000	95°	85°	79°	+ .40°	+ 6.0%
13	Generating Station—Gulf Coast	65,000	104.6°	87°	76.5°	+ .45°	+ 3.3%
14[2]	Petroleum Refinery—Gulf Coast	17,500	111°	90°	80°	+ .47°	+ 3.5%
15[2]	Petroleum Refinery—North Central	4,150	110°	75°	68°	— .10°	— 0.6%
16	Petroleum Refinery—East Central	19,400	120°	85°	75°	+ .65°	+ 5.5%
17[2]	Petroleum Refinery—Gulf Coast	57,500	120°	85°	79°	— .17°	— 1.3%
18	Petrochemical Plant—Gulf Coast	15,000	115°	90°	78°	+ .70°	+ 5.3%
19[2]	Air Conditioning—Mid-Atlantic	3,600	95°	85°	78°	+ .70°	+12.6%
20[2]	Atomic Test Facility—North West	70,000	112°	87°	65°	+1.50°	+ 5.9%
21	Chemical Plant—Gulf Coast	1,350	155°	86°	81°	+ .10°	+ 1.4%
22	Air Conditioning—Gulf Coast	7,000	93.5°	86°	80°	+ .30°	+ 6.0%
23[3]	Petroleum Refinery—Central	60,000	120°	80.6°	70°	+ .25°	+ 1.84%
24	Paper Mill—South Central	10,000	116°	86°	79°	+ .05°	+ 0.25%
25	Air Conditioning—South Central	6,000	105°	85°	78°	+ .25°	+ 2.7%
26	Generating Station—Mid-South	38,000	103.2°	90°	80°	+ .70°	+ 5.4%
27	Generating Station—West Coast	34,000	96°	80°	70°	+ .42°	+ 3.75%

NOTES: 1) Total capacity four identical towers: results are average of tests conducted on two towers. 2) Cooling Tower Institute observer present during tests. 3) Test of tower remodeled to increase performance after more than 13 years of service. 4) Test results are adjusted to specified conditions. 5) + indicates lower cold water temperature than specified; — indicates higher cold water temperature than specified.

"TEST YOUR TOWER"—a brochure that details the Marley method of tower testing, and "ANALYZE YOUR BIDS"—one that presents a logical means of pre-purchase evaluation, should be in every engineering library. Your Marley engineer will gladly furnish copies or just send a request to

THE MARLEY COMPANY MARLEY **KANSAS CITY, MISSOURI**



fully adjustable, TUBULAR BUS SUPPORT*

This bus support, made of high-strength bronze throughout, has the following outstanding features:

- Fully adjustable to any angle whatsoever within a complete circle (360°).
- No need to lift bus out of support to change angular position.
- To change position within seconds, merely loosen 4 insulator mounting bolts, rotate assembly to desired angle and re-tighten bolts.
- No inaccessible internal bolt employed for angular setting.
- The only bus support whose angular adjustment does not jeopardize its overall strength.
- By reversing cap bus can be tight-mounted or slip-mounted.

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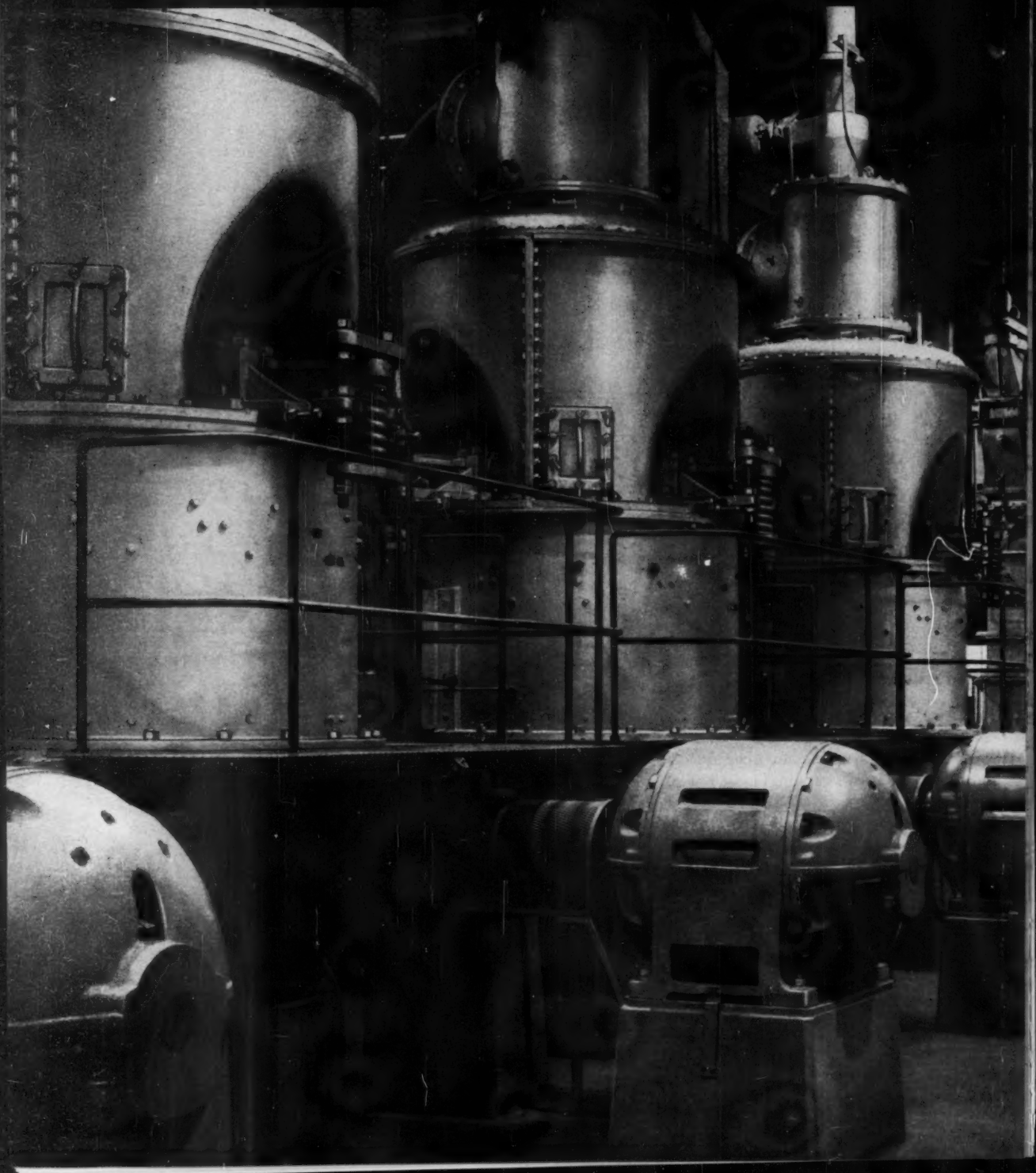
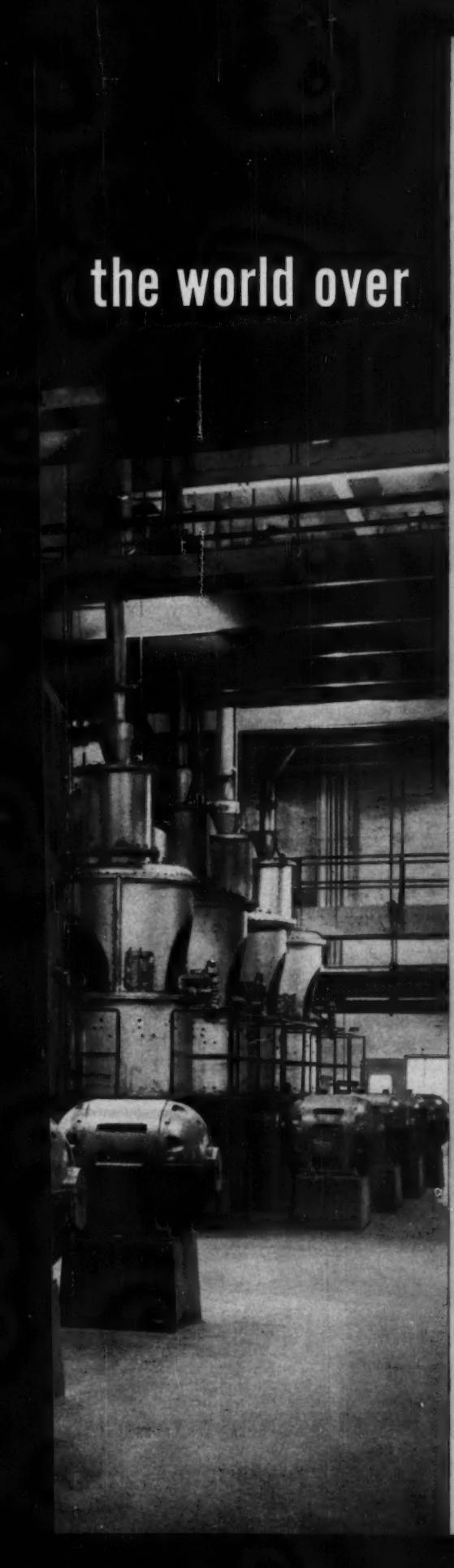
prepare the daily BTU diets of boilers





the world over

C-E RAYMOND BOWL MILLS pulverize lignite in Mallorca, Spain ... coke in Buenos Aires ... semi-bituminous coal in Limburg, Holland ... bituminous in Tanagawa, Japan ... furfural residue in Tennessee ... and petroleum coke in Indiana. But their biggest field of application, by far, is pulverizing various kinds of coal in hundreds of American utility plants from coast to coast. In all, they feed the boilers of the world with some 37,000 tons of fuel each hour — boilers with an aggregate steam generating capacity of about ...

400,000,000 lb. per hr.

There are eight big reasons why the C-E Raymond Bowl Mill is so popular — reasons that are important to you if pulverized fuel is part of your plant picture. They are ...

1. **Handles High Moisture Fuels** — High moisture fuels are handled without difficulty because the Bowl Mill premixes raw coal with the dried product in an atmosphere up to 700 F air. Even lignite with 50% moisture is thoroughly dried.
2. **Low Power Consumption** — Rapid flow of material through the mill, prompt removal of fine coal, fast drying and relatively low weight of grinding elements all combine to assure minimum power consumption.
3. **Continuous Service** — The Bowl Mill provides continuous service for long periods because there is no metal-to-metal contact between rings and rolls and wear is minimized. Logs showing 20,000 hours of continuous operation are not uncommon.
4. **Low Maintenance** — Maintenance is required less frequently because the Bowl Mill stays in service for longer periods. When replacement of parts is necessary, outage time is minimized because of the ease with which the machine can be taken apart and reassembled.
5. **Fineness Control** — Changes in fineness control can be made while the Bowl Mill is operating because the necessary adjustments are made from the outside. The mill need not be stopped.
6. **Automatic Grinding Adjustment** — Grinding pressure is automatically adjusted to suit fuel characteristics because the Bowl Mill uses spring-loaded journals which instantaneously compensate for variations in coal grindability.
7. **Infrequent Lubrication** — Only infrequent lubrication is required with the Bowl Mill. When required, it can be done from outside the mill without taking it out of service.
8. **Vibrationless-Quiet** — The Bowl Mill's grinding rollers make no metal-to-metal contact with the grinding ring, assuring quiet, vibrationless operation.

Whether you are considering pulverizers for your present plant expansion program or for future requirements, we suggest you investigate the advantages of the Bowl Mill as outlined above and described more fully in our Catalog PC-8.

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ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

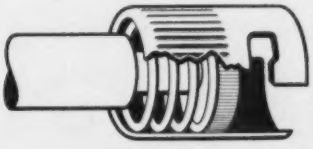
NEW Quick Disconnects Make Kuhlman

The Simplest Transformer To Service

Disconnecting high voltage leads or replacing internal fuses takes only a matter of seconds in the newly designed Kuhlman Pole-Type transformer.

High voltage bushings (sidewall or cover mounted) are connected or disconnected by a finger tip bayonet-type connector. A slight turn to the right connects. A slight turn to the left disconnects. No longer is it necessary to fumble with tools in close quarters or hunt for lost nuts or bolts.

The new Kuhlman high voltage internal connector assures more positive contact, too. The connector's lock pin is guided into position by a grooved joining cup. With a slight turn it locks in place under spring pressure, assuring positive contact always.

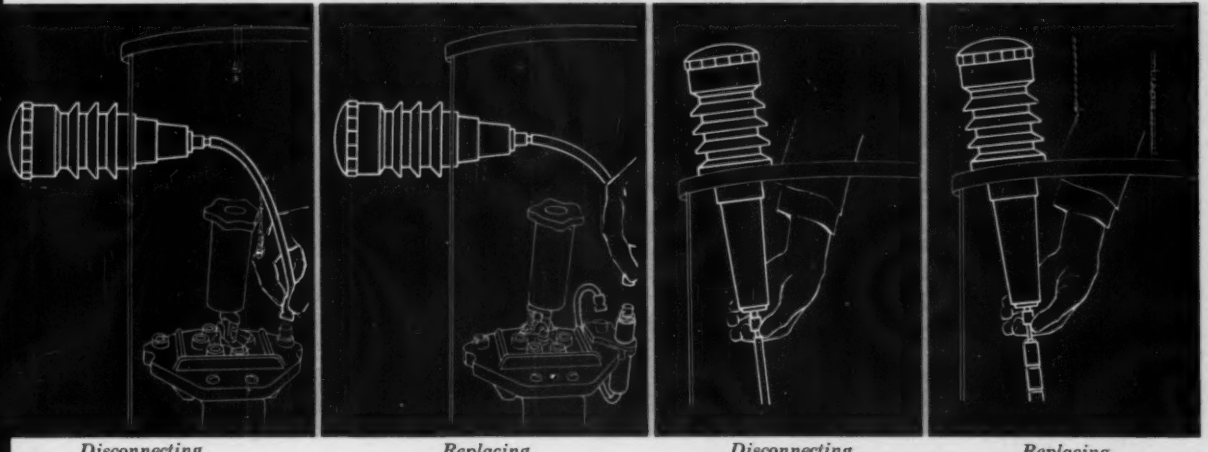


In the event a sidewall bushing fuse has to be replaced, it now can be done in a jiffy, right on the pole. A convenient spring clip releases the fuse from its mounting. Fuse disconnects break the line and coil connection and allow the blown fuse to be replaced without the use of tools.

Disconnecting cover-mounted bushings to remove the transformer cover is even simpler. An easily-reached quick disconnect at the base of the bushing disconnects the high voltage lead. Bushing-mounted protective link fuses are changed by the same simple device.

Quick disconnects are only one of many features. Get all the facts about the *all new* '60 Kuhlman transformer . . . that gives you more for your transformer dollar.

These connections now require no tools—are simpler to make:



Disconnecting sidewall bushings

Replacing sidewall bushing fuses

Disconnecting cover-mounted bushings

Replacing cover-mounted fuses

KUHLMAN POLE TYPE TRANSFORMERS

KUHLMAN ELECTRIC COMPANY, Birmingham, Mich. **Factories at Bay City, Mich.; Crystal Springs, Miss.; Salinas, Calif.**

from Sangamo Electric:

An interim report to the Electric Utility Industry on your response to our question . . .

GLENN M. DeKRAKER
Assistant Marketing Manager

Why Call it Demand?

Does the word "demand" make you bristle?

While we all know that demand charges are fully justified from the standpoint of basic economics, the electric power customer often fails to realize that it is he who is making demands on the utility rather than the other way around. If psychology has a place in rate-making, should the word "demand" have ever been admitted to the electric utility vocabulary?

Electric customers, tabbed with a *demand* charge on their electric bills, have a tendency to bristle at the term.

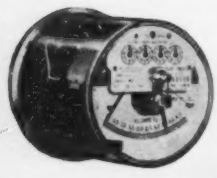
If we remove *d* metering, it be concept . . . an and less offe as load, ne

Recently, in an advertisement, we questioned the use of the word "demand" applied to the measurement of power usage. The point was made that it is time for all of us to reconsider our use of the word, and asked for your opinions and suggestions about what to do with this thorn-in-the-side term.

Many of you have taken time to write us. We've heard from utilities, editors, and manufacturers throughout this country, Canada and South America. Some of you went to great lengths to express your preferences for a new term. Most all of you who wrote agreed with us . . . it's time to take the "demand" out of demand metering and substitute some term that is less offensive and more easily understood.

So far, you've suggested 43 different words or terms which you believe will do a better public relations job than "demand." "Capacity" is the word you mentioned most often, followed by "load peak" and "load," then by "maximum load," "use," and "capacity charge." Suggestions are still coming in.

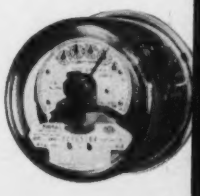
If you haven't already written us as to your suggestion, we would like to hear from you.



Regardless of what you call "demand" measurement, you can depend on Sangamo Meters to do it better.

Sangamo offers the most complete line of demand* measuring instruments in the industry . . . equipment to indicate and record demands from the smallest values to the largest encountered by the electric power industry. The line includes singlephase and polyphase Type D mechanical demand registers, Lincoln indicating and graphic demand meters, digital demand recorders and translating systems for Kw, Kvar, and Kva demand. You can look to Sangamo for all types of demand measurement.

*Until all the returns are in, and you've selected a new term.



SANGAMO ELECTRIC COMPANY, Springfield, Ill.

JM39-10

Editorial Comment

JANUARY 25, 1960

EHV Cable Insulation Research Needed

With the expanding use of extra high voltage today, insulating materials are entering upon a new era which may well see the replacement of oil and paper with new synthesized insulations designed specifically for the highest voltages.

The initial push appears likely to come in the cable area. Systems of the next ten years will bring a requirement for 350- to 500-kv cable. In this voltage range, research is needed today to develop dielectrics that can extend cable capabilities beyond the present barriers imposed by high dielectric losses and charging power reactive requirements.

Writing in this issue of Electrical World (page 66), an internationally recognized cable engineer observes that if the electrical industry is to achieve a satisfactory solution to these formidable problems, it must tailor insulating materials specifically to the purpose at hand. This can be done using presently-feasible techniques of high polymer chemistry and by capitalizing on our present knowledge of what causes deterioration of insulation at extra high voltages.

An intensive drive to develop new insulating materials by tailoring the molecule would be a natural in rounding the present 345-kv cable tests at Cornell University into a balanced whole. The Cornell tests for the most part employ conventional materials and designs. And the test program of load cycles at overvoltage and excess temperatures can well be said to be directed at the cable of *today*. A proposed high polymer research, although broader and more basic, looks further ahead and may well be called the cable of *tomorrow*.

These two researches, therefore, would complement and balance each other. They deserve the industry's cooperation and support.

What's Behind the Boost in '60 Spending Plans?

The table below shows 1959 electric utility capital spending did not quite live up to expectations. Undoubtedly its failure to hit the target was due to the steel strike and attendant affect on the economy. Thus such spending areas as generation and transmission, that depend directly on steel or the loads from steel-fed industries, fell short of the mark. However, distribution, being affected more by the rapid rise in residential and commercial kwhr sales, lived up pretty much to earlier expectations. But while these shifts crimped 1959 spending they changed 1960 plans from a minus to a plus as indicated by the comparison with EW's forecast of last fall.

Utility Capital Budgets & Expenditures (Millions of Dollars)

	1959			1960			
	Budget	Expenditures	Net Change	EW Est. 9/14/59	Budget	Net Change from EW Est.	% Change '60 Budget over '59 Expenditures
Generation	$2,475	$2,369	−$106	$2,146	$2,283	+$137	+ 3.6%
Transmission	787	708	− 79	732	813	+ 81	+14.8%
Distribution	1,455	1,413	− 42	1,595	1,595	0	+12.9%
Miscellaneous	197	179	− 18	179	209	+ 30	+16.1%
Total	$4,914	$4,669	−$245	$4,652	$4,900	+$248	+ 4.9%

Federal Power Spending Heads Upward

Six power projects starts or additions are sought; REA predicts 1961 loan demands will total $240 million but it will get only $220 million; reactor spending to slide

Up, up, up—that's the pattern of fiscal 1961 budget requests sent to Congress last week by President Eisenhower. The White House has made a concerted effort to hold the line on many public works expenditures, but the net result—partially caused by last year's enactment of 67 new starts by Congress—is a much bigger federal outlay.

For the first time in several years, Eisenhower is asking for money to start these new federal projects: 36 by the Army Engineers, six by the Bureau of Reclamation, three by the Tennessee Valley Authority, one by the International Boundary (Mexico) and Water Commission. Most of these "new starts" are for non-power projects, but the list does include Green Peter (Ore.), Yellowtail (Mont., Wyo.), Blue Mesa (Colo.), and Melton Hill (Tenn.) reservoirs plus two more hydro turbines at Bull Shoals Reservoir, Ark. And the Administration also is asking Congress for authority to start work on the Fryingpan-Arkansas project, Colo.

Interior Secretary Fred Seaton explained the number of new starts on an improved federal budget position, which gives "more room" for new federal construction. Other, possibly more important, reasons are: (1) it's an election year and (2) Congress has shown that it has the votes to override another Administration attempt to hold the line on new starts.

U.S.B.R. Seeks Record Amount

The Bureau of Reclamation—asking for a record "useable" budget of $313 million—wants $2.5 million to start work on the $109-million Yellowtail Dam on the Big Horn River, Wyo. and Mont., and for $1.4 million to start work on the $72.5-million Blue Mesa Dam on the Gunnison River, Colo.—part of the 159,000-kw Curecanti project.

A six-month labor strike at Glen Canyon Dam site, now ended, plus effects from the national steel strike, cut expected construction at the dam by $20 million during the present fiscal year, and as a result, Reclamation expects to tack this amount onto its work on Glen Canyon during fiscal 1961—hitting a record $63 million. Bad weather also caused delays in construction at Reclamation's Flaming Gorge Dam, and its fiscal 1961 budget of $18.4 million also will include carried-over funds.

Interior is seeking $1 million for its Virgin Islands Corp to build a new generating facility at St. Croix; and it also plans a power station in conjunction with a proposed $1,235,000 saline water distillation unit at St. Thomas.

The Army Engineers, requesting a record $936.4-million budget, is asking $1.4 million to start work on its $64-million Green Peter Dam (81,000 kw), Ore., plus $100,000 to start work on hydro power units No. 7 & 8 at Bull Shoals Dam, Ark. The Corps is requesting $282.9 million to continue work on other multi-purpose projects, including power. No money is being requested,

Here's How Federal Power Funds Will Be Spent

	1959	1960	1961
	Fiscal Years (In Thousands)		
Tennessee Valley Authority			
Power facilities	$72,622	$97,009	$143,437
Transmission lines	22,340	30,770	31,770
Melton Hill Dam	53	212	6,100
Rural Electrification			
Loan funds available	412,881	378,090	220,090
Corps of Engineers			
All multipurpose projects, including power & new starts	193,521	223,772	284,468
Bonneville Power Administration			
Transmission lines	20,934	21,450	20,220
Southwestern Power Administration			
Total-transmission line construction	1,024	1,144	1,325
Bureau of Reclamation			
Multi-purpose projects, including new starts	143,968	141,738	174,570
Upper Colorado fund, including new starts	67,569	58,535	89,600
Missouri Basin transmission funds	11,093	18,132	24,415
Total	$946,005	$970,852	$995,995

JM59-10

in President's Election-Year Budget

significantly, for planning work at the Rampart Dam site, Alaska, which public power supporters are expected to promote in the fiscal 1961 Public Works appropriation bill.

TVA plans to start construction —using power and bond revenues —on a second 600,000-kw unit at its Paradise, Ky., steam plant, while the bulk of its $143-million construction budget will go to continue work at the Widows Creek, Colbert and Paradise No. 1 steam plants, additional Wilson and Wheeler dam hydro units, plus a new generating unit at an eastern area steam station. TVA plans to split the 1961 cost of $6.1 million 50-50 between appropriations and power and bond revenues to start work on Melton Hill Dam (72,000 kw).

The President again is asking Congress to raise the level of interest rates on rural electrification loans to the "going rate" paid by the U.S. Treasury for long-term obligations, plus an added 0.2% to cover REA administration costs. A Treasury estimate at this rate is about 4.4%. But the Administration isn't pushing this year for enactment of legislation to permit private financing for co-ops. The budget message urges passage of legislation, already introduced in Congress, to create a "revolving fund" for REA loan funds, and it also emphasizes that "a mutually owned financing institution" will be "vitally" needed for the future.

A peculiar feature of the REA budget—sure to raise Congressional eyebrows—is an apparent $20-million deficiency in its requested funds to cover expected co-op loan applications during fiscal 1961. REA predicts its 1961 loan demands will run about $240 million, but it is seeking only enough funds to cover $220 million in new loans. The 1961 budget calls for $110 million in new appropriations, and this, along with $110 million in carryover funds and revisions, would give REA a $220-million fund.

The $240-million figure for expected loan requests includes the controversial $54-million Hoosier loan application, and its approval or disapproval could spell the difference between an REA surplus or deficit in operation funds. Normal carryover funds—from one year to the next—run between $100 million and $200 million, and REA plans to practically wipe this figure out in 1961.

Southwestern Power Administration is asking for $1.3 million for new construction—one new substation plus increased capacity at several others—its largest appropriation in several years. Southeastern Power Administration, as in the past, is asking only for $800,000 for operation and maintenance.

BPA Plans New Lines

Bonneville Power Administration's construction budget request of $20,220,000 includes $1.3 million for continued work on construction projects plus $6.5 million to start work on new transmission lines to carry power to load centers from Ice Harbor, Cougar, Hills Creek, The Dalles, Priest Rapids, Rocky Reach and Wanapum dams. An additional $10.9 million (up $1 million from the previous year) is being asked for operation and maintenance of the Bonneville system.

Atomic energy appropriations requests for fiscal 1961 represent no increase over the current year's authorizations.

The Eisenhower budget foreshadows no major reactor construction program. Actually, the $2.6 billion proposed for the Atomic Energy Commission falls short of the $2.8 billion current year amount. Funds for new reactor development is hardest hit by the lower fiscal year 1961 figure, with only $101 million being earmarked for new reactor starts as against the current year's $190-million amount.

The President is requesting $40 million for the construction of power reactors in cooperation with private and public power groups in 1961, again shy of the $55.5-million amount approved for the cooperative power reactor program for the current year.

The budget includes $178 million in the operating portion for the civilian power reactor development program.

A request will be submitted later to Congress for construction of an additional civilian power prototype reactor, the type, size and cost of which will be determined by the commission after considering the state of technology and the cooperation proposed by industry.

Decrease Planned on AEC Reactor Expenditures

	1959	1960	1961
Civilian Power Reactors		(In Thousands)	
Government program	$ 84,629	$100,000	$ 98,000
Reactors, construction	130,705	190,332	101,644
Co-op arrangements program	15,540	19,595	25,400
Euratom program	2	2,100	5
General supporting R&D	28,736	43,934	49,500
Merchant Ship, Propulsion			
Reactors	4,696	7,474	8,300
Army power reactors	9,010	11,958	15,000
Naval propulsion reactors	83,401	86,800	85,000
Aircraft propulsion reactors	66,851	62,832	73,000
Missile propulsion reactors	22,073	34,750	40,300
Satellite power sources	7,654	12,400	14,000
Operational services & Equip	24,466	20,563	22,800
Total, reactor development	**$477,763**	**$592,738**	**$532,949**

Puerto Rico Gets 'Second Round' Reactor

Country's three years of effort produce AEC contract for 16.3-Mw boiling-water superheat reactor costing $11 million

In January, 1955, the Atomic Energy Commission's cooperative power demonstration program was inaugurated with the so-called first-round of invitations. Under this, private, cooperative and public power groups and the commission are participating jointly to develop prototype power reactor plants which demonstrate technical and economic feasibility of various reactor concepts.

The second-round invitations for 5 to 40-Mw reactors were issued in September, 1955, when it was specified that the government would construct and own the reactors. This made it possible for public groups to participate in the overall program, since one of the second-round ground rules was that public groups would only be required to finance the conventional portion of the power plant and provide a site for it.

Seven proposals were received before the original second-round deadline of Feb. 1, 1956. Two of these are leading to fruition—Elk River, Minn., and Piqua, Ohio projects. During the last session of Congress, however, legislation made it possible to re-open the second round of the cooperative demonstration power program.

The second-round terms will be utilized for a 16.3-Mw boiling-water superheat reactor which the AEC will finance and own and the Puerto Rican Water Resources Authority will operate. In addition to the reactor cost, AEC will pay maintenance costs and sell the reactor's steam to PRWRA. The Puerto Rican agency will provide a site near the city of Rincon and pay between $3.1 million and $3.5 million for turbogenerating facilities, the switchyard and transmission lines.

Total plant costs are estimated at $11 million.

Use of superheated steam is expected to increase plant efficiency to 30 or 35% as against the best efficiencies of 25% for present A-plants.

The AEC-PRWRA contract was the culmination of negotiations that began in 1956 when Milton Eisenhower, on a good will swing through Latin American countries, suggested that an atomic educational and research center and a power reactor be built in Puerto Rico for the purpose of integrating Latin American science.

The PRWRA in 1957 came to the AEC with a proposal to build a reactor. Commission officials announced two weeks ago that it was finally decided to go ahead with the project on the basis of extensive pre-research and development work which satisfactorily proved the reactor was feasible.

General Nuclear Engineering Co will build the reactor.

Cesium Cell Converts Heat Directly to Alternating Current

A cesium cell capable of converting heat directly to alternating current has been developed by General Atomic Div of General Dynamics Corp. The device has produced enough energy to light a series of lamps, and is a product of research partially supported by a group of western utilities.

Although no figures concerning the cesium cell's efficiency were obtainable, General Dynamics called it, "the first successful conversion of heat into alternating current in significant amounts." The ac—in the 100-kc range—was produced with the cell operating at approximately 3,500F. No rotating machinery or converting equipment was used.

Dr Frederic de Hoffmann, president of General Atomic, predicted that direct conversion equipment may someday replace the boilers, turbines and generators in power plants, but stressed the fact that much research and development work would have to be carried out before such direct conversion equipment could be built for large-scale commercial applications.

The experiments leading to the cesium cell were conducted at the company's John Jay Hopkins Laboratory for Pure and Applied Science in San Diego, Calif.

Utilities contributed more than $500,000 to the research. They are: Arizona Public Service Co, California Electric Power Co, Pacific Power & Light Co, Portland General Electric Co, Public Service Co of Colorado, Public Service Co of New Mexico, Utah Power & Light Co, San Diego Gas & Electric Co, and Washington Water Power Co.

Atomic Cooperation Praised by Soviet Nuclear Chief

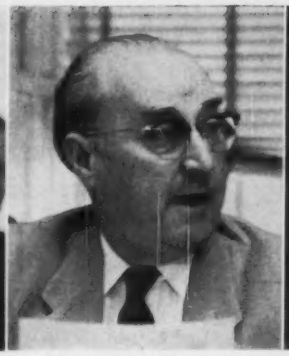
The growing cooperation between U. S. and Soviet atomic scientists was praised by V. Yemelyanov, chief of Central Atomic Energy Administration, in a recent Pravda article. In a review of the countries' exchange visits of scientists he noted: "Unprecedented interest in our country has been aroused in America."

He forecasted a trend to employment of fast neutron reactors capable of breeding nuclear fuel, noting that the Soviets have been working on this problem since 1949.

As for his recent visit to the U. S., he stated that the Dresden station's machinery that regulates the reactor is underneath while such machinery is above Soviet plant reactors. Some engineering problems common to the Enrico Fermi plant and Russia's fast breeder reactor—both using liquid sodium—are being solved by Soviet scientists, he said.

ENGLE

ELLIS



HOLIFIELD

OLDS

Public Power Plans a 'Holding Action'

In two-day Washington session, leaders call for greater federal development of hydro, atomic reactors, and generation

A "holding action" against the Eisenhower Administration during its last year in office—plus new demands for federal power development—highlighted the plans of public power leaders at a two-day session last week in Washington of the ECIC (Electric Consumers Information Committee).

Sen Clair Engle (D-Calif.) pointed out that public power had lost "no major battles" during the Eisenhower Administration, and he predicted a new drive in 1961, when a new Administration is elected.

Former Federal Power Commission Chairman Leland Olds called for consideration this year of his perennial, controversial plan for "giant power" generation and transmission facilities. He added that anything short of this—including the recent recommendations of New York Gov Rockefeller's special task force on the state's power resources—would leave the U. S. second best in the race with Russia.

Clyde Ellis, General Manager of the National Rural Electric Cooperatives Assn, in a surprise move, submitted his resignation as chairman of ECIC, but no action was taken on it. He probably will be succeeded by Alex Radin.

Engle opened the two-day session with a blast at possible moves by private power partisans to block public power expansion in the 1960 Congress. He listed "danger points" to public power as:

1. New proposals to push for "partnership" development of power at federal hydro sites.

2. An attempt to block spending of federal funds to build the Trinity Dam power plant (Calif.).

3. Approval of Pacific Gas & Electric Co's proposed 230-kv transmission connection with Bonneville Power Administration.

4. New attempts to raise REA interest rates.

5. Further Administration "delays" in starting new federal power projects.

6. Approval of a five-company plan to interconnect federal power dams now under construction as part of the Upper Colorado River project.

The most radical program was outlined by Leland Olds, who called for establishment of "giant regional generation and transmission cooperatives" and a "public and cooperative investment finance corporation" to finance the portions of these "joint, integrated" facilities which would be owned and operated on a public or non-profit basis.

Olds also ridiculed the recent recommendations of the report for power development in New York State—and the Empire State Utilities Power Resources Associates, set up to study ways of meeting Gov Rockefeller's recommendations. He charged that the report "makes it perfectly clear that the country cannot depend on the private power companies to lead the way into giant power . . . The report . . . backs away timorously from regional integration which would add further advantages in the way of lower fuel costs and time—diversity of peak loads . . ."

Olds charged that "all the New York companies want is a nice little 'giant' that won't subject them either to Federal Power Commission or Securities & Exchange Commission control." He concluded that the report was weighted "heavily" in favor of power companies, but that "Dr James C. Bonbright has filed with the governor a supplementary report which has not yet been released . . . He suggests that the state power authority should have had recognized status in the pooling of the state's power resources . . . We shall await with interest release of the Bonbright comment."

Rep Holifield castigated the present atom power reactor programs as failing to measure up to predictions, and he demanded a strong federal program to put reactor development back on course.

With the exception of one small homogeneous experimental reactor at Oak Ridge, said Holifield, "not one watt of civilian power is being generated in the U. S. by atomic reactors." All existing reactors, he pointed out, are now shut down.

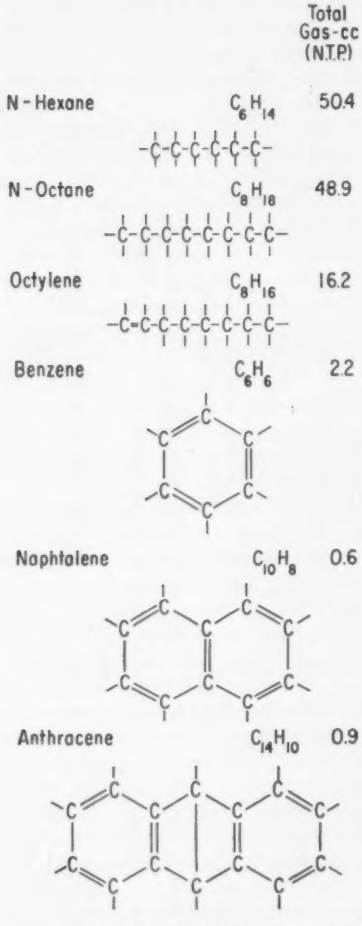
Holifield noted that the Shippingport reactor has been closed for planned replacements of fuel elements. The Argonne reactor is "under modification," while both the Dresden and Santa Susana reactors have been closed due to failure.

To Solve the EHV Dielectric Dilemma:

Research is needed to develop new dielectrics that can extend the capabilities of future EHV cable beyond thermal limits imposed by losses in oil-paper insulation

KENNETH S. WYATT, Engineer of Cables, Phelps Dodge Copper Products Corp, New York, N. Y.

Recent efforts in designing and producing cables at 345 to 500 kv have brought out forcibly the limitations of oil-impregnated paper insulation. The dielectric loss, even after extreme purification of oil and paper is sufficient to heat the cable to the maximum allowable conductor temperature, thereby reducing current-carrying capacity at higher voltages. After service deterioration of the insulation, the situation becomes even worse. The high specific inductive capacity (S.I.C.) of oil-impregnated paper also militates against its use at these high voltages where charging current limits the possible useful lengths. In consequence, the attention of the EHV cable designer has turned to plastics and other synthetic materials.



STRUCTURE DIAGRAMS of straight chain paraffin, olefin and one, two and three-ring aromatics, with corresponding volume of gas evolved under gamma radiation

Synthetic insulating materials suitable for EHV cables boil down to three: mylar and polystyrene for taped structures, and polyethylene for extruded structures. The first of these, polyethylene terephtha!ate, is soon eliminated by its high loss, particularly after use at 70C and above. Polystyrene tape structures, while satisfying the cardinal requirements of low dielectric loss and very high dielectric strength, nevertheless can be rejected because polystyrene softened and swelled in mineral oil, did not bend well, and more importantly, is limited by a strain-release temperature of about 85C.

Great attention, therefore, has been focussed on the third and sole survivor, namely, polyethylene. At first sight its prospects for EHV insulation appeared extremely bright. It has very low dielectric loss, very high dielectric strength, low S. I. C. and extremely low moisture absorption and transmission. It can be extruded readily and is low in cost. It became universally used in the communications industry, and completely replaced gutta-percha in the under-ocean telegraph and telephone cables of the world. It has found increasing use for low-and medium-voltage cables. There are now several installations at around 35 kv and one at 46 kv. But in all these apparently successful installations, the stress has been kept below 75 vpm.

To make a cable in the 350-to 500-kv range that is not uneconomically and impracticably bulky, the maximum stress must be of the order of 200 to 400 vpm. Tests on the material itself and on trail cable lengths show that polyethylene simply will not stand up at such stresses over long periods of time. Dc life tests in condenser form are reported to show that the life does not reach an asymptotic value after a few hours, but keeps dropping even after two years, indicating a continuing deterioration within the insulation. Failures on cables occurred at unexpectedly low stresses and unpredictably. While there was much interest abroad in polyethylene for dc submarine cables at 100 and 200 kv at one time, trials have been so disappointing that it has completely dropped out of sight and is no more heard of.

There are some who plead that polyethylene has not been given a fair chance, that air and moisture have been forced into the cable insulation by the extrusion, that specks of dirt or foreign matter have got in, that the resin granules were of uneven quality, and that extrusion and cooling temperatures have not been properly controlled. There is some truth in this defense on grounds of defective application. But the weakness goes far deeper than these superficial defects; it is inherent in the nature of the polyethylene itself.

Perhaps contributing to the dielectric weakness is the reversible crystallization occurring within the operating temperature range of the cable.

After reviewing the experiences with polyethylene at high stresses over the last 15 years, one is hit with great force by the conclusion that polyethylene has entirely the wrong chemical constitution for longtime high electric stresses. Although it is a polyolefin, it contains very little chemical unsaturation, and is very near to a polymerized straight-chain paraffin. It is now nearly 30 years since it was shown

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Text of a talk at the invitation of the Detroit Edison Co before a research and engineering group at their Engineering Research Laboratory, Dec. 8, 1959

Design the Molecule!

by Schoepfle and Fellows that the maximum in gas evolution under the electron beam was achieved by using straight chain paraffins. Of course, they were using liquids, not solids such as we are concerned with. They further showed that the semi-solid petrolatum, chiefly paraffins, with which high-voltage paper cables were then impregnated, gave off hydrogen copiously under electric discharges such as the electron beam, and that this property was the cause of the orgy of cable failures experienced in the 1920-1930 era. What was wanted, it seemed clear, was an impregnating oil which under discharge did not evolve gas.

Typical of the results is the volume of gas given off under the electron beam (170,000-v Coolidge tube) by a straight-chain paraffin, an olefin, and one, two and three-ring aromatic:

Hexane	Octane	Octylene
50.4	48.9	16.2

Benzene	Naphthalene	Anthracene
2.2	6.6	0.9

The copious gas evolution of the saturated paraffins (hexane, octane) is cut down to one-third by the introduction of a double bond into the chain (acetylene) and is almost eliminated by the aromatic ring structures benzene, naphthalene, and anthracene. For example, that of naphthalene is 1/80 that of hexane. In practice a gassy petrolatum oil can be rendered practically non-gassing by dissolving in it 5% naphthalene.

Corona discharge in general is similar to the electron beam in its action on hydrocarbons and qualitatively confirms the values given above.

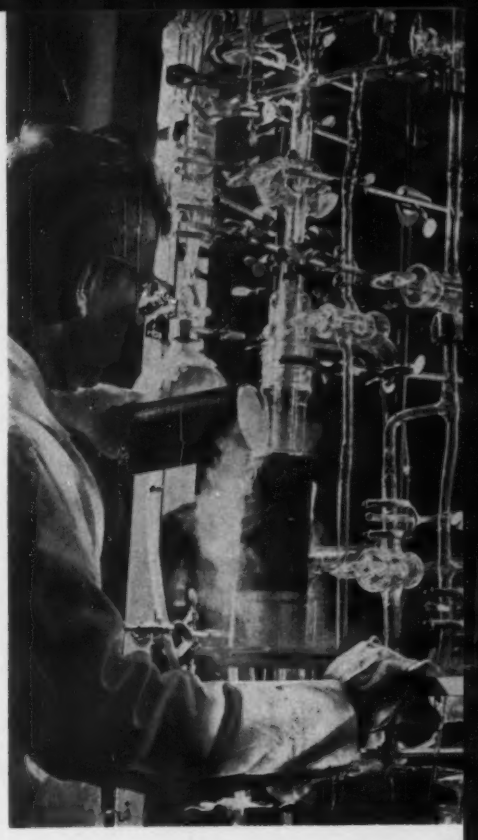
Radiation using Cobalt 60 produces a similar trend to that above. Polyethylene actively responds at first with cross-linking, then with degradation, polyisobutylene softens and reverts to isobutylene gas; but the aromatic polystyrene is hardly affected.

The ideal non-gassing oil should contain, according to these studies, some unsaturated aromatic rings attached at intervals to an olefinic chain, e.g., polystyrene. When the aromatic rings themselves form the chain, the material has less stability.

Although the relation between gassing of the cable impregnant and cable breakdown has not been clearly established, many studies proceeding on the assumption that there was a valid relationship have produced notable results. One oil company, using the electron beam and corona methods, selected a non-gassing crude, and using the same method, selected the optimum degree of refinement of that crude for electrical stability. These oils are widely-used today both here and in Europe for insulation, cables, condensers and transformers. In a case where a 132-kv oil filled cable in England was giving off gas at the reservoirs, owing to the use of a highly-refined water white cable impregnating oil, the trouble was easily overcome by withdrawing the oil and dissolving 5% of moth balls in it.

Today in most cable laboratories, the gassing of oils under some form of electrical discharge, usually corona, is taken as one measure of its suitability for use in high-voltage cables, the oil with the lowest gas evolution being the most desirable.

Although gassing appears intimately associated with long-time breakdown in hydrocarbon liquids, is it an important factor in hydrocarbon solids? If a short piece of polyethylene insulated cable is passed through the electron beam so as to receive sufficient dosage, and is then heated in an oven to above the softening point, the insulation expands due to the formation of myriads of small bubbles of hydrogen. Because the hydrogen atom strips very readily from the near-paraffin chain, the electron beam produces hydrogen copiously throughout the polyethylene structure. It cannot escape, but must remain in solution under high pressure until melting of the resin permits expansion and formation of bubbles. The long-time dielectric strength would be adversely affected by hydrogen throughout the molecular structure. On the other hand, an aromatic



ring compound such as polystyrene subjected to the same dosage does not produce visible hydrogen and there should be no drop in dielectric strength. In another case, Einstman at the recent meeting of the NRC Insulation Committee described how they took a high-molecular weight polamide and introduced aromatic groups along the chain to exceptionally improve its resistance to a 2 Mev beam (Van de Graaff) ("ionizing radiation") and also its thermal stability, due to the protective effects of the resonance-stabilized aromatic nuclei. These examples are typical of a great deal of scattered data which make reasonable the assumption that the gassing characteristics of homogeneous hydrocarbon solids are also intimately associated with long-time dielectric breakdown.

New techniques have become available to the high polymer chemist for designing and synthesizing a molecule for specific uses. Gordon Kline of the Bureau of Standards recently stated that now molecules should be designed for special purposes although he called for more exact information on bond strengths. The attention of those in the electrical industry interested in solving the basic problem of 500-

kv cable insulation should therefore now be directed at the feasibility of designing a molecule specifically for such service. The cardinal properties of very low dielectric loss and exceptionally high longtime dielectric strength can readily be assured. Designing becomes more difficult when a long list of physical properties has to be obtained at the same time. In the final stages resort must be made to cut and try methods. A further limitation is that the desired molecule must be capable of being produced at a low price.

The time has now come, it is believed, when it is possible to surmount these difficulties.

Requirements for the ideal EHV cable dielectric molecule are:

1. **A pure hydrocarbon** (without oxidation instability due to tertiary hydrogens) to insure low loss and low S.I.C. and to insure low moisture absorption and transmission.
2. **Aromatic ring structure** for long-time dielectric stability under high electric stress.
3. **Connecting chains** and side-chains and branching with some oxidation-stable unsaturation to obtain adequate flexibility, tensile strength, toughness, high softening point (if a thermoplastic), cold brittle point of —30C or lower, etc.
4. **Capability of production** from available materials at a low cost, e.g., solutions suitable only for museums must be eliminated.
5. **Easy to extrude** or to form into tapes.

The rate of progress in developing improved resins will depend directly on the speed and effectiveness of the screening tests to separate the sheep from the goats. These tests will have to be considered very carefully as they are obviously an important part of the project. The preliminary tests will have to be made on small samples. The more promising materials can then be tested on a larger scale. A third set of tests on an actual cable scale can then be made. The general nature of these tests is as follows:

1. Physical properties
2. Oxidation stability
3. Resistance to ionizing radiation: Van de Graaff, corona, Cobalt 60
4. Dielectric loss and power factor
5. Dielectric strength both short-time and long-time, ac and dc
6. Examination by infra-red spectrograph
7. Cornell load cycle test on cable lengths at overvoltage.

The development of an ideal insulation for 500-kv cables through proper design of the molecule is a basic research. It will require top-flight high polymer chemists. A major effort in this direction by the industry deserves a well-planned business-like program at an industrial laboratory, not occasional efforts by BS and MS students at a university.

A considerable investment in electrical test equipment would be necessary.

The main drive would be on 500-kv insulation. But with adequate direction and with the test equipment installed, it would be easy to add several young chemists to the staff and put them to work on secondary problems. In this way, a second benefit would accrue to the electrical industry, namely, the training of insulation chemists and engineers.

One such secondary problem is to develop an insulation for medium voltage cables—11 to 50 kv—that will be entirely unaffected by water regardless of the integrity of any jacket which may have been provided. This problem is regarded in some quarters as of prime importance because the maintenance of oil-impregnated paper cable protected with lead sheath is becoming more and more expensive. With corrosion, mechanical damage and the increase expansion and contraction of the sheath attendant upon heavier loading, cracks develop leaving an open path for moisture to the moisture-hungry paper within. An insulation proof against moisture would be of inestimable benefits to the electrical industry.

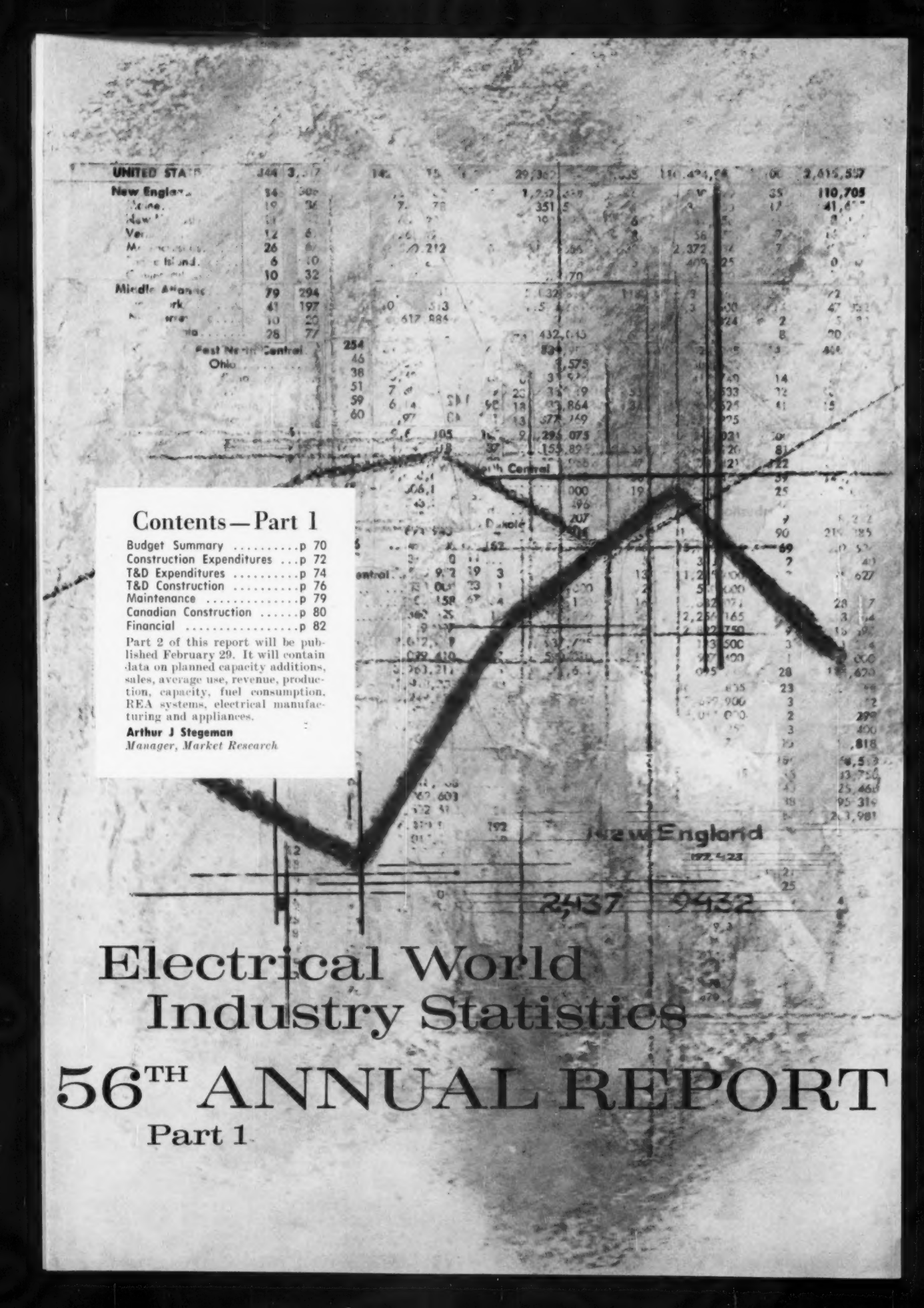
The first question asked by both American and European chemical companies is, "How many hundred thousand pounds a year will be required?" As a result, no resin has ever been specially devised for the electrical industry, the latter has had to take what has been developed for mass markets, e.g., packaging and dime store goods. The amount of insulation required for 350 kv to 500 kv cable in the next ten years is very small. Therefore, if this fundamental problem is to be solved, the industry will have to make the effort to solve it. Of course, it is to be hoped that the resin which is the solution to the 500 kv problem will be at the same time the solution to the mass market at lower voltages.

To achieve success there must be close collaboration between those carrying out this research and the chemical industry. It must be made clear to the latter that short-time dielectric strength is not the most important criterion — almost any pure solid hydrocarbon will give high values. It is the dc long-time dielectric strength that counts. For example, life tests on polyethylene over a two or three year period are most disappointing. It must be made clear that the paraffinic structure of polyethylene with virtually no unsaturation, makes it the worst possible choice for EHV insulation. Furthermore, the molecule must have inherent oxidation stability, both because of milling and extrusion at the cable factory and because it may be operated continuously at 70 to 100C. Polypropylene has an active tertiary hydrogen making for inherent oxidation instability; even if loaded with anti-oxidants it is not satisfactory. It is obvious the tertiary hydrogen should be eliminated by copolymerization.

If the electrical industry is to reach a solution of some of the formidable problems lying ahead in the next ten to 15 years, it must develop insulating materials specifically for the purpose in hand. This can be achieved through "tailoring the molecule." The old policy of mass-producing one resin and then modifying it for application in different industries will have to give way to one where a resin will be specifically designed for each purpose. The cost of developing each new resin need not be exorbitantly high.

In the next decade, there will be a requirement for 350 to 500-kv cables. Such cables can be built, but their load-carrying ability will

(*Continued on page* 142)



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Part 2 of this report will be published February 29. It will contain data on planned capacity additions, sales, average use, revenue, production, capacity, fuel consumption, REA systems, electrical manufacturing and appliances.

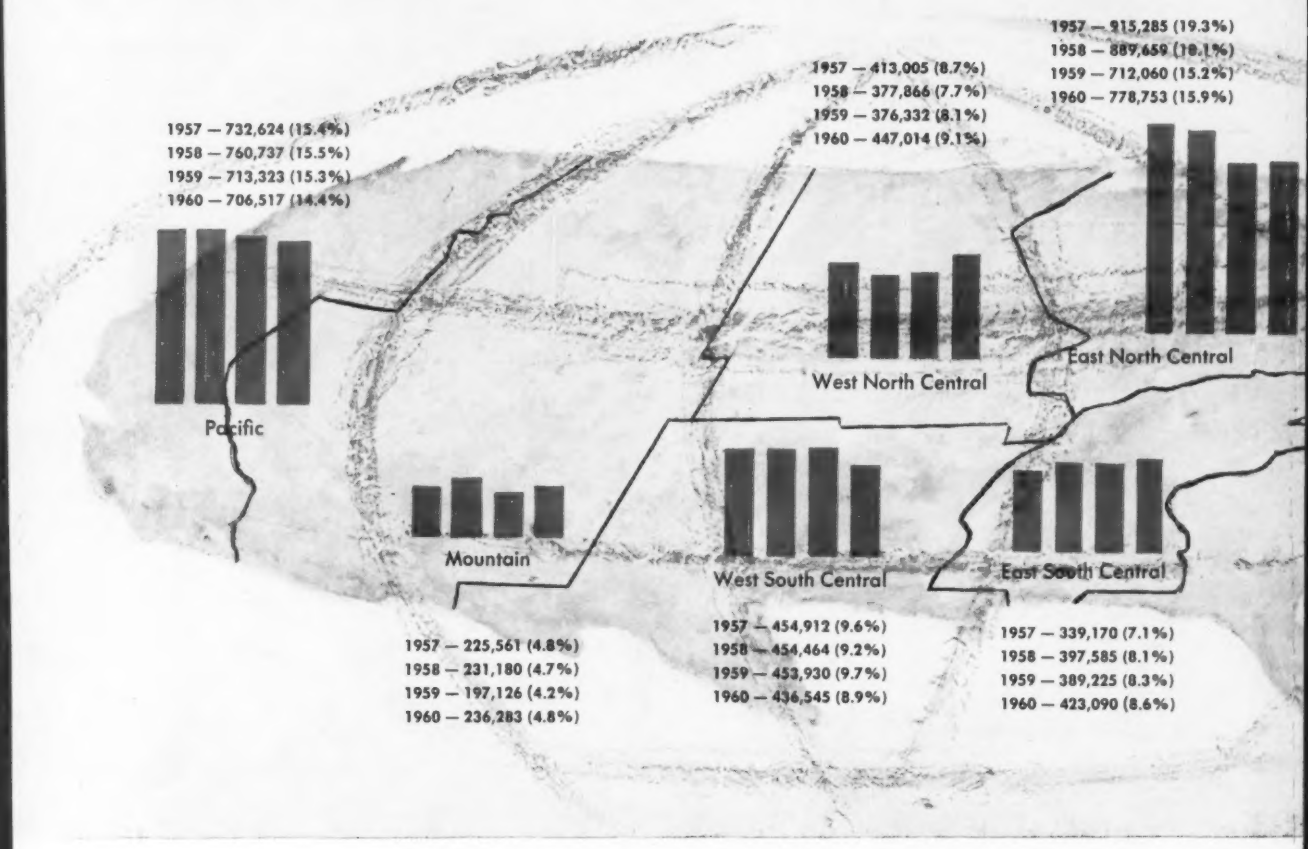
Arthur J Stegeman
Manager, Market Research

Electrical World Industry Statistics

56TH ANNUAL REPORT

Part 1

BUDGET

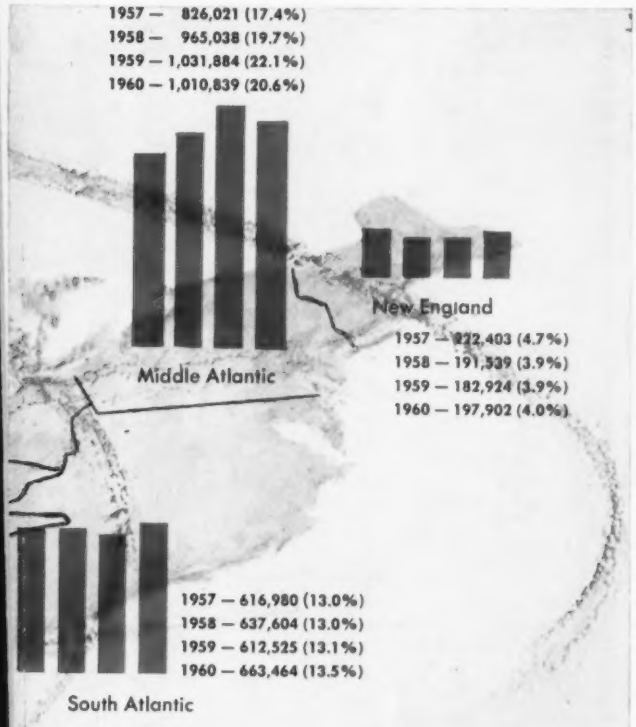


Capital Expenditures—Millions of Dollars*

	Generation	Transmission	Distribution	Miscellaneous	Total
1950	1,275	425	1,127	109	2,936
1951	1,344	504	1,089	131	3,068
1952	1,925	577	1,118	119	3,739
1953	2,088	647	1,201	127	4,063
1954	1,940	666	1,288	122	4,016
1955	1,548	571	1,343	161	3,623
1956	1,479	598	1,518	186	3,781
1957	2,234	747	1,566	199	4,746
1958	2,582	764	1,373	187	4,906
1959	2,369	708	1,413	180	4,669
1960‡	2,283	813	1,595	209	4,900

Source: Electrical World Surveys. * Continental U. S. ‡ Prospective.

1960 Budget Bounces Back to $4.9 Billion —Up 4.9% Over 1959



*Construction Expenditures —Thousands of Dollars and % Total U.S.**

Electric utilities in the continental United States plan to spend $4.9 billion on new or improved facilities in 1960. If carried through, 1960 expenditures will be 4.9% over last year and almost match the record $4.91 billion chalked up in 1958.

Generation expenditures which accounted for better than 52% of the 1958 total are budgeted at $2.3 billion in 1960 or only 46.4% of the total. This rate will be 3.9% under last year's $2.4 billion and 11.9% under the high of $2.6 billion in 1958.

However, while total generation spending is scheduled to decline, cuts will not be across-the-board. Fuel-plant expenditures which hit a peak of $2.0 billion in 1958 are slated to drop 7.0% to $1.6 billion in 1960 while hydro-plant additions will climb to a new peak of $726 million—up 4.5%.

Transmission plant expenditures are heading for a record $813 million in 1960, up 14.8% over 1959, apparently as a result of construction delays caused by the steel industry shutdown.

This year's spending on distribution plant is pegged at almost $1.6 billion or 12.9% more than last year reflecting the additional requirements imposed by substantial increases in kwhr sales to residential and commercial customers in 1959.

Miscellaneous expenditures for new office buildings, warehouses, office equipment, and vehicles are estimated at $209 million in 1960—up $29 million or 16.1% over last year.

Power company budgets are in line with changes in total industry spending plans for 1960. Power company budgets are scheduled to hit $3.5 billion in 1960—up 3.4% or $115 million over 1959. This will put them 7.1% under the high of $3.8 billion set in 1958.

Generation spending is the only area of difference between power company and total industry spending. Here the decline is across-the-board with fuel down 8.4% to $1.3 billion and hydro off 22.0% to $92 million. This adds to a total drop of 9.5% in 1960.

However, spending plans for transmission, distribution, and miscellaneous more than make up for the slack in generation. Transmission expenditures are estimated at $625 million in '60 for a gain of 12.8% or $71 million. Distribution spending will be up $165 million or 14.2% to a record $1.3 billion. And miscellaneous, while only 4.8% of the total, will be up 15.8% to $169 million.

Federal agencies plan to spend $468 million in 1960—a whopping 39.7% more than last year. Generation expenditures are mainly responsible with a 43.2% jump to $371 million. Fuel plant spending will be up 50.0% to $102 million and hydro construction will be up 40.8% to $269 million. Following close behind is transmission, pegged at $90 million—up $20 million or 28.6%.

Municipal, state, and power district systems plan a boost of 1.3% in 1960 appropriations with generation down 4.5% and transmission and distribution up 30.0% and 8.8% respectively.

Cooperatives are the only group planning to spend less money in 1960. Their budgets are down 15.8% to $144 million with distribution showing the only plus sign—up 3.3% to $94 million.

ontinental U. S.

1959 Construction Expenditures

	Fuel	Hydro	Trans-mission	Distri-bution	Miscel-laneous	Total
New England						
Power Companies	65,462	1,491	26,120	74,543	7,060	174,676
Municipal, State & Power District Systems	3,084	4	950	3,174	237	7,449
Cooperatives	.....	.....	.....	764	35	799
Federal Agencies	.....	.....	.....	.....	.....	.....
Total	**68,546**	**1,495**	**27,070**	**78,481**	**7,332**	**182,924**
Middle Atlantic						
Power Companies	367,082	4,522	121,958	270,775	30,237	794,574
Municipal, State & Power District Systems	7,121	223,296	1,551	2,926	216	235,110
Cooperatives	.....	.....	.....	2,078	122	2,200
Federal Agencies	.....	.....	.....	.....	.....	.....
Total	**374,203**	**227,818**	**123,509**	**275,779**	**30,575**	**1,031,884**
East North Central						
Power Companies	306,507	1,083	138,621	173,569	41,171	660,951
Municipal, State & Power District Systems	14,668	.....	1,494	10,668	979	27,809
Cooperatives	8,385	.....	4,554	9,602	759	23,300
Federal Agencies	.....	.....	.....	.....	.....	.....
Total	**329,560**	**1,083**	**144,669**	**193,839**	**42,909**	**712,060**
West North Central						
Power Companies	90,458	278	32,495	88,395	8,999	220,625
Municipal, State & Power District Systems	34,420	.....	6,429	16,144	3,756	60,749
Cooperatives	15,610	.....	9,201	16,668	1,738	43,217
Federal Agencies	.....	46,000	5,741	.....	.....	51,741
Total	**140,488**	**46,278**	**53,866**	**121,207**	**14,493**	**376,332**
South Atlantic						
Power Companies	208,521	11,355	75,934	205,085	16,808	517,703
Municipal, State & Power District Systems	32,911	10	8,590	14,170	2,117	57,798
Cooperatives	.....	.....	6,183	13,941	1,400	21,524
Federal Agencies	.....	14,500	1,000	.....	.....	15,500
Total	**241,432**	**25,865**	**91,707**	**233,196**	**20,325**	**612,525**
East South Central						
Power Companies	71,000	22,032	29,568	32,496	12,379	167,475
Municipal, State & Power District Systems	22,730	.....	8,677	27,214	1,551	60,172
Cooperatives	9,500	.....	4,657	18,756	990	33,903
Federal Agencies	68,000	27,675	27,000	.....	5,000	127,675
Total	**171,230**	**49,707**	**69,902**	**78,466**	**19,920**	**389,225**
West South Central						
Power Companies	176,261	.....	51,109	124,362	9,894	361,626
Municipal, State & Power District Systems	14,772	.....	4,420	18,410	2,989	40,591
Cooperatives	.....	.....	2,880	16,338	1,312	20,530
Federal Agencies	.....	28,830	2,283	.....	70	31,183
Total	**191,033**	**28,830**	**60,692**	**159,110**	**14,265**	**453,930**
Mountain						
Power Companies	38,297	12,424	24,562	45,179	6,736	127,198
Municipal, State & Power District Systems	3,935	159	2,161	12,167	1,552	19,974
Cooperatives	5,003	.....	5,957	10,226	1,126	22,312
Federal Agencies	.....	17,852	9,537	245	8	27,642
Total	**47,235**	**30,435**	**42,217**	**67,817**	**9,422**	**197,126**
Pacific						
Power Companies	77,300	65,175	53,554	148,766	12,956	357,751
Municipal, State & Power District Systems	33,262	161,663	15,666	53,798	7,230	271,619
Cooperatives	.....	.....	518	2,186	159	2,863
Federal Agencies	.....	56,415	24,675	.....	.....	81,090
Total	**110,562**	**283,253**	**94,413**	**204,750**	**20,345**	**713,323**
Total Continental United States						
Power Companies	1,400,888	118,360	553,921	1,163,170	146,240	3,382,579
Municipal, State & Power District Systems	166,903	385,132	49,938	158,671	20,627	781,271
Cooperatives	38,498	.....	33,950	90,559	7,641	170,648
Federal Agencies	68,000	191,272	70,236	245	5,078	334,831
Total	**1,674,289**	**694,764**	**708,045**	**1,412,645**	**179,586**	**4,669,329**
Alaska	214	6,208	894	1,107	90	8,513
Hawaii	5,138	.....	1,086	4,958	339	11,521
Total United States	**1,679,641**	**700,972**	**710,025**	**1,418,710**	**180,015**	**4,689,363**
U. S. Possessions						
Puerto Rico & Virgin Islands	22,205	.....	5,143	9,870	2,355	39,573

—Thousands of Dollars

	Fuel	Hydro	Trans-mission	Distri-bution	Miscel-laneous	Total
New England						
Power Companies	64,287	2,308	28,997	84,699	7,388	187,679
Municipal, State & Power District Systems	2,640	21	1,008	4,485	376	8,530
Cooperatives	.....	.....	850	813	30	1,693
Federal Agencies	.....	.....	.....	.....	.....	.....
Total	**66,927**	**2,329**	**30,855**	**89,997**	**7,794**	**197,902**
Middle Atlantic						
Power Companies	261,686	5,923	157,669	306,224	31,559	763,061
Municipal, State & Power District Systems	5,269	224,653	11,513	3,356	241	245,032
Cooperatives	.....	.....	.....	2,473	273	2,746
Federal Agencies	.....	.....	.....	.....	.....	.....
Total	**266,955**	**230,576**	**169,182**	**312,053**	**32,073**	**1,010,839**
East North Central						
Power Companies	298,545	508	140,912	232,467	52,716	725,148
Municipal, State & Power District Systems	20,114	.....	1,920	13,129	4,083	39,246
Ccoperatives	840	.....	2,744	9,986	789	14,359
Federal Agencies	.....	.....	.....	.....	.....	.....
Total	**319,499**	**508**	**145,576**	**255,582**	**57,588**	**778,753**
West North Central						
Power Companies	106,591	545	45,188	98,084	9,725	260,133
Municipal, State & Power District Systems	47,408	.....	19,163	19,901	5,339	91,811
Cooperatives	5,840	.....	12,198	17,001	1,460	36,499
Federal Agencies	.....	41,800	16,771	.....	.....	58,571
Total	**159,839**	**42,345**	**93,320**	**134,986**	**16,524**	**447,014**
South Atlantic						
Power Companies	223,218	27,356	83,416	220,100	18,973	573,063
Municipal, State & Power District Systems	26,441	91	2,557	14,305	958	44,352
Cooperatives	.....	.....	4,986	15,335	728	21,049
Federal Agencies	.....	24,000	1,000	.....	.....	25,000
Total	**249,659**	**51,447**	**91,959**	**249,740**	**20,659**	**663,464**
East South Central						
Power Companies	59,619	24,301	19,514	38,466	12,123	154,023
Municipal, State & Power District Systems	10,751	.....	9,729	27,750	1,637	49,867
Cooperatives	3,000	.....	3,521	18,381	1,188	26,090
Federal Agencies	102,000	56,110	29,000	.....	6,000	193,110
Total	**175,370**	**80,411**	**61,764**	**84,597**	**20,948**	**423,090**
West South Central						
Power Companies	129,855	.....	67,371	137,338	12,803	347,367
Municipal, State & Power District Systems	14,230	.....	3,638	16,948	2,015	36,831
Cooperatives	.....	.....	1,614	17,155	879	19,648
Federal Agencies	.....	30,549	2,000	.....	150	32,699
Total	**144,085**	**30,549**	**74,623**	**171,441**	**15,847**	**436,545**
Mountain						
Power Companies	32,176	12,653	35,049	51,293	6,668	137,839
Municipal, State & Power District Systems	21,246	231	3,020	12,849	2,779	40,125
Cooperatives	.....	.....	5,723	10,124	1,103	16,950
Federal Agencies	.....	30,423	10,646	290	10	41,369
Total	**53,422**	**43,307**	**54,438**	**74,556**	**10,560**	**236,283**
Pacific						
Power Companies	107,083	18,872	46,925	159,369	17,187	349,436
Municipal, State & Power District Systems	13,486	139,885	12,794	60,663	8,707	235,535
Cooperatives	.....	.....	1,110	2,514	986	4,610
Federal Agencies	.....	86,141	30,795	.....	.....	116,936
Total	**120,569**	**244,898**	**91,624**	**222,546**	**26,880**	**706,517**
Total Continental United States						
Power Companies	1,283,060	92,466	625,041	1,328,040	169,142	3,497,749
Municipal, State & Power District Systems	161,585	364,881	65,342	173,386	26,135	791,329
Cooperatives	9,680	.....	32,746	93,782	7,436	143,644
Federal Agencies	102,000	269,023	90,212	290	6,160	467,685
Total	**1,556,325**	**726,370**	**813,341**	**1,595,498**	**208,873**	**4,900,407**
Alaska	.....	2,012	3,280	1,251	183	6,726
Hawaii	3,352	.....	710	5,575	364	10,001
Total United States	**1,559,677**	**728,382**	**817,331**	**1,602,324**	**209,420**	**4,917,134**
U. S. Possessions						
Puerto Rico & Virgin Islands	16,710	165	7,610	8,126	2,518	35,129

1959 Transmission and Distribution Expenditures

	Transmission Lines		Underground Construction		Primary Distribution		Substations
	66 Kv & Up	22–65.9 Kv	Trans-mission	Distri-bution	Total	Rural	
New England							
Power Companies	3,435	804	2,403	3,262	5,280	426	8,798
Municipal, State & Power District Systems	24	239	500	.....	703	42	336
Cooperatives	.....	.....	.....	.....	764	764	.....
Federal Agencies	.....	.....	.....	.....	.....	.....	.....
Total	**3,459**	**1,043**	**2,903**	**3,262**	**6,747**	**1,232**	**9,134**
Middle Atlantic							
Power Companies	29,131	7,627	20,324	37,740	38,722	4,199	68,528
Municipal, State & Power District Systems	3,384	28	67	.....	208	18	1,631
Cooperatives	.....	.....	.....	.....	1,343	846	42
Federal Agencies	.....	.....	.....	.....	.....	.....	.....
Total	**32,515**	**7,655**	**20,391**	**37,740**	**40,273**	**5,063**	**70,201**
East North Central							
Power Companies	44,305	9,913	4,630	6,145	70,506	3,902	43,293
Municipal, State & Power District Systems	.....	57	71	550	4,075	113	890
Cooperatives	2,765	488	.....	.....	5,214	4,693	1,187
Federal Agencies	.....	.....	.....	.....	.....	.....	.....
Total	**47,070**	**10,458**	**4,701**	**6,695**	**79,795**	**8,708**	**45,370**
West North Central							
Power Companies	10,917	942	815	1,718	22,531	8,640	21,255
Municipal, State & Power District Systems	4,671	362	.....	267	4,355	2,180	8,661
Cooperatives	6,572	.....	.....	10	11,472	9,522	2,418
Federal Agencies	1,910	.....	.....	.....	.....	.....	6,331
Total	**24,070**	**1,304**	**815**	**1,995**	**38,358**	**20,342**	**38,665**
South Atlantic							
Power Companies	25,671	2,413	3,463	5,979	86,883	9,296	28,529
Municipal, State & Power District Systems	4,579	410	36	15	4,143	749	3,083
Cooperatives	3,137	298	.....	23	7,758	5,508	1,536
Federal Agencies	500	.....	.....	.....	.....	.....	26
Total	**33,887**	**3,121**	**3,499**	**6,017**	**98,784**	**15,553**	**33,174**
East South Central							
Power Companies	15,087	2,585	.....	235	6,587	299	12,720
Municipal, State & Power District Systems	2,878	772	100	818	10,642	2,368	6,885
Cooperatives	3,069	513	.....	.....	11,581	9,844	923
Federal Agencies	7,000	1,000	.....	.....	.....	.....	19,000
Total	**28,034**	**4,870**	**100**	**1,053**	**28,810**	**12,511**	**39,528**
West South Central							
Power Companies	21,725	438	303	1,831	38,576	5,356	33,287
Municipal, State & Power District Systems	2,345	.....	.....	174	3,000	454	2,559
Cooperatives	1,883	174	.....	.....	10,916	8,514	754
Federal Agencies	.....	.....	.....	.....	.....	.....	2,000
Total	**25,953**	**612**	**303**	**2,005**	**52,492**	**14,324**	**38,600**
Mountain							
Power Companies	10,905	2,278	.....	464	17,388	4,220	12,003
Municipal, State & Power District Systems	1,175	96	.....	127	3,897	68	1,886
Cooperatives	2,475	2,107	.....	32	7,823	6,649	699
Federal Agencies	.....	78	.....	.....	164	.....	565
Total	**14,555**	**4,559**	.....	**623**	**29,272**	**10,937**	**15,153**
Pacific							
Power Companies	31,303	1,076	.....	9,757	53,007	7,772	32,884
Municipal, State & Power District Systems	4,592	1,343	5,463	3,917	6,905	396	10,950
Cooperatives	276	156	.....	8	1,379	1,117	78
Federal Agencies	11,936	.....	.....	.....	.....	.....	12,739
Total	**48,107**	**2,575**	**5,463**	**13,682**	**61,291**	**9,285**	**56,651**
Total Continental United States							
Power Companies	192,479	28,076	31,938	67,131	339,480	44,110	261,297
Municipal, State & Power District Systems	23,648	3,307	6,237	5,868	37,928	6,388	36,881
Cooperatives	20,177	3,736	.....	73	58,250	47,457	7,637
Federal Agencies	21,346	1,078	.....	.....	164	.....	40,661
Total	**257,650**	**36,197**	**38,175**	**73,072**	**435,822**	**97,955**	**346,476**
Alaska	600	189	235	.....	714	10	146
Hawaii	.....	40	.....	.....	415	.....	171
Total United States	**258,250**	**36,426**	**38,410**	**73,072**	**436,951**	**97,965**	**346,793**
U. S. Possessions							
Puerto Rico & Virgin Islands	1,140	380	40	250	2,006	1,890	3,510

—Thousands of Dollars

1960

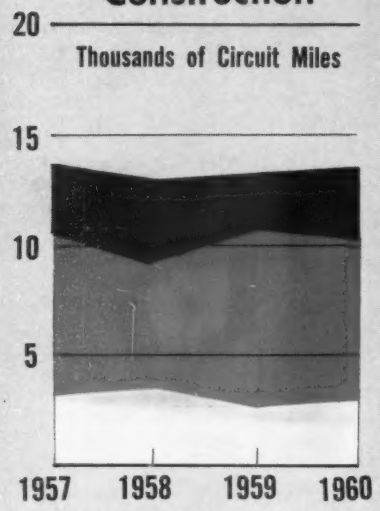
	Transmission Lines		Underground Construction		Primary Distribution		Substations
	66 Kv & Up	22–65.9 Kv	Trans-mission	Distri-bution	Total	Rural	
New England							
Power Companies	6,898	954	909	3,037	5,895	569	7,620
Municipal, State & Power District Systems	53	66	560	270	501	.....	842
Cooperatives	850	.....	.....	.....	813	813	.....
Federal Agencies	.....	.....	.....	.....	.....	.....	.....
Total	**7,801**	**1,020**	**1,469**	**3,307**	**7,209**	**1,382**	**8,462**
Middle Atlantic							
Power Companies	37,799	10,022	1,766	40,190	42,697	4,466	77,750
Municipal, State & Power District Systems	12,500	.....	.....	.....	197	.....	426
Cooperatives	.....	.....	.....	.....	1,411	917	25
Federal Agencies	.....	.....	.....	.....	.....	.....	.....
Total	**50,299**	**10,022**	**1,766**	**40,190**	**44,305**	**5,383**	**78,201**
East North Central							
Power Companies	42,717	7,597	1,739	7,479	77,931	4,447	64,233
Municipal, State & Power District Systems	.....	75	610	465	3,971	46	2,690
Cooperatives	1,840	120	.....	.....	5,046	4,390	1,443
Federal Agencies	.....	.....	.....	.....	.....	.....	.....
Total	**44,557**	**7,792**	**2,349**	**7,944**	**86,948**	**8,883**	**68,366**
West North Central							
Power Companies	19,518	1,992	30	2,260	24,044	8,553	22,386
Municipal, State & Power District Systems	9,267	1,521	.....	225	4,555	2,261	10,507
Cooperatives	8,650	733	.....	15	11,574	9,722	2,444
Federal Agencies	.....	.....	.....	.....	.....	.....	4,660
Total	**37,435**	**4,246**	**30**	**2,500**	**40,173**	**20,536**	**39,997**
South Atlantic							
Power Companies	29,139	4,009	1,706	9,840	69,074	5,255	33,201
Municipal, State & Power District Systems	495	4	56	75	2,440	606	2,533
Cooperatives	1,772	1,161	.....	.....	8,091	5,097	1,303
Federal Agencies	300	100	.....	.....	.....	.....	540
Total	**31,706**	**5,274**	**1,762**	**9,915**	**79,605**	**10,958**	**37,577**
East South Central							
Power Companies	5,772	3,030	.....	287	7,262	273	9,891
Municipal, State & Power District Systems	2,704	723	.....	845	17,629	2,488	7,030
Cooperatives	1,250	603	.....	.....	11,856	9,485	1,008
Federal Agencies	8,000	1,000	.....	.....	.....	.....	18,000
Total	**17,726**	**5,356**	.....	**1,132**	**36,747**	**12,246**	**35,929**
West South Central							
Power Companies	28,083	777	808	1,896	39,402	5,407	33,815
Municipal, State & Power District Systems	1,692	.....	.....	233	2,986	452	2,405
Cooperatives	1,004	563	.....	.....	11,307	8,480	434
Federal Agencies	1,034	.....	.....	.....	.....	.....	2,382
Total	**31,813**	**1,340**	**808**	**2,129**	**53,695**	**14,339**	**39,036**
Mountain							
Power Companies	18,445	1,626	61	1,211	18,277	3,608	15,676
Municipal, State & Power District Systems	1,640	256	13	60	4,118	101	2,323
Cooperatives	2,516	1,061	.....	.....	6,751	5,643	972
Federal Agencies	1,205	25	.....	.....	185	.....	3,830
Total	**23,806**	**2,968**	**74**	**1,271**	**29,331**	**9,352**	**22,801**
Pacific							
Power Companies	24,197	1,231	909	13,959	48,252	4,609	34,112
Municipal, State & Power District Systems	4,253	1,382	1,808	4,837	7,108	323	9,581
Cooperatives	740	.....	.....	4	1,138	888	161
Federal Agencies	14,720	.....	.....	.....	.....	.....	15,840
Total	**43,910**	**2,613**	**2,717**	**18,800**	**56,498**	**5,820**	**59,694**
Total Continental United States							
Power Companies	212,568	31,238	7,928	80,159	332,834	37,187	298,684
Municipal, State & Power District Systems	32,604	4,027	3,047	7,010	43,505	6,277	38,337
Cooperatives	18,622	4,241	.....	19	57,987	45,435	7,790
Federal Agencies	25,259	1,125	.....	.....	185	.....	45,252
Total	**289,053**	**40,631**	**10,975**	**87,188**	**434,511**	**88,899**	**390,063**
Alaska	3,000	137	20	525	452	20	367
Hawaii	55	70	.....	.....	425	.....	160
Total United States	**292,108**	**40,838**	**10,995**	**87,713**	**435,388**	**88,919**	**390,590**
U. S. Possessions							
Puerto Rico & Virgin Islands	**1,569**	**300**	**100**	**375**	**2,156**	**2,060**	**7,644**

	Transmission Circuit Miles		Underground Cable Miles		Primary Distribution Pole Miles		Substations Kva
	66 Kv & Up	22–65.9 Kv	Trans-mission	Distri-bution	Total	Rural	
New England							
Power Companies	67	59	18	140	551	94	1,106,000
Municipal, State & Power District Systems	1	31	...	.....	81	17	10,000
Cooperatives	.....	.....	...	.....	65	65	.....
Federal Agencies	.....	.....	...	.....	.....	.....	.....
Total	**68**	**90**	**18**	**140**	**697**	**176**	**1,116,000**
Middle Atlantic							
Power Companies	597	292	199	1,219	2,890	554	4,195,000
Municipal, State & Power District Systems	19	6	...	.....	42	11	397,000
Cooperatives	.....	.....	...	.....	244	200	5,000
Federal Agencies	.....	.....	...	.....	.....	.....	.....
Total	**616**	**298**	**199**	**1,219**	**3,176**	**765**	**4,597,000**
East North Central							
Power Companies	1,428	423	35	137	3,010	523	3,284,000
Municipal, State & Power District Systems	.....	5	2	9	296	77	110,000
Cooperatives	348	61	...	.....	1,227	1,117	80,000
Federal Agencies	.....	.....	...	.....	.....	.....	.....
Total	**1,776**	**489**	**37**	**146**	**4,533**	**1,717**	**3,474,000**
West North Central							
Power Companies	546	231	3	24	1,074	333	1,674,000
Municipal, State & Power District Systems	225	57	...	12	552	485	463,000
Cooperatives	1,228	.....	...	.....	4,112	3,577	193,000
Federal Agencies	67	.....	...	.....	.....	.....	407,000
Total	**2,066**	**288**	**3**	**36**	**5,738**	**4,395**	**2,737,000**
South Atlantic							
Power Companies	921	196	24	137	4,315	1,261	4,128,000
Municipal, State & Power District Systems	169	46	...	.....	1,042	216	672,000
Cooperatives	350	31	...	1	2,547	2,038	154,000
Federal Agencies	.....	.....	...	.....	.....	.....	16,000
Total	**1,440**	**273**	**24**	**138**	**7,904**	**3,515**	**4,970,000**
East South Central							
Power Companies	431	207	...	2	1,159	93	1,237,000
Municipal, State & Power District Systems	102	31	2	7	862	403	741,000
Cooperatives	495	87	...	.....	2,842	2,473	71,000
Federal Agencies	145	25	...	.....	.....	.....	1,600,000
Total	**1,173**	**350**	**2**	**9**	**4,863**	**2,969**	**3,649,000**
West South Central							
Power Companies	878	69	1	84	3,221	1,500	4,582,000
Municipal, State & Power District Systems	137	.....	...	4	528	164	385,000
Cooperatives	346	18	...	.....	3,275	2,555	51,000
Federal Agencies	.....	.....	...	.....	.....	.....	120,000
Total	**1,361**	**87**	**1**	**88**	**7,024**	**4,219**	**5,138,000**
Mountain							
Power Companies	469	231	...	24	1,732	1,060	728,000
Municipal, State & Power District Systems	59	13	...	9	448	15	202,000
Cooperatives	388	494	...	2	2,951	2,803	44,000
Federal Agencies	.....	11	...	.....	56	.....	31,000
Total	**916**	**749**	...	**35**	**5,187**	**3,878**	**1,005,000**
Pacific							
Power Companies	910	93	...	192	3,258	776	2,449,000
Municipal, State & Power District Systems	106	93	59	80	553	102	823,000
Cooperatives	44	28	...	2	374	307	6,000
Federal Agencies	97	.....	...	.....	.....	.....	617,000
Total	**1,157**	**214**	**59**	**274**	**4,185**	**1,185**	**3,895,000**
Total Continental United States							
Power Companies	6,247	1,801	280	1,959	21,210	6,194	23,383,000
Municipal, State & Power District Systems	818	282	63	121	4,404	1,490	3,803,000
Cooperatives	3,199	719	...	5	17,637	15,135	604,000
Federal Agencies	309	36	...	.....	56	.....	2,791,000
Total	**10,573**	**2,838**	**343**	**2,085**	**43,307**	**22,819**	**30,581,000**
Alaska	26	46	...	1	93	1	11,750
Hawaii	.....	8	...	.....	50	.....	5,000
Total United States	**10,599**	**2,892**	**343**	**2,086**	**43,450**	**22,820**	**30,597,750**
U. S. Possessions							
Puerto Rico & Virgin Islands	38	17	...	5	457	420	150,450

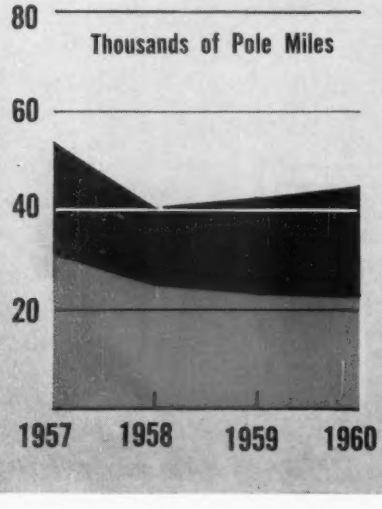
	Transmission Circuit Miles		Underground Cable Miles		Primary Distribution Pole Miles		Substations Kva
	66 Kv & Up	22–65.9 Kv	Trans-mission	Distri-bution	Total	Rural	
New England							
Power Companies	164	81	11	112	668	103	771,000
Municipal, State & Power District Systems	3	7	2	3	42	.....	48,000
Cooperatives	9	.....	...	.....	65	65	.....
Federal Agencies	.....	.....	...	.....	.....	.....	.....
Total	**176**	**88**	**13**	**115**	**775**	**168**	**819,000**
Middle Atlantic							
Power Companies	498	313	139	1,416	2,948	558	5,476,000
Municipal, State & Power District Systems	.....	.....	...	.....	42	.....	19,000
Cooperatives	.....	.....	...	.....	251	206	2,000
Federal Agencies	.....	.....	...	.....	.....	.....	.....
Total	**498**	**313**	**139**	**1,416**	**3,241**	**764**	**5,497,000**
East North Central							
Power Companies	1,418	456	14	170	3,155	615	5,491,000
Municipal, State & Power District Systems	.....	5	16	11	260	57	138,000
Cooperatives	184	16	...	.....	1,249	1,087	347,000
Federal Agencies	.....	.....	...	.....	.....	.....	.....
Total	**1,602**	**477**	**30**	**181**	**4,664**	**1,759**	**5,976,000**
West North Central							
Power Companies	714	197	...	43	2,569	342	1,536,000
Municipal, State & Power District Systems	511	245	...	11	573	571	993,000
Cooperatives	983	147	...	1	4,600	4,140	149,000
Federal Agencies	.....	.....	...	.....	.....	.....	233,000
Total	**2,208**	**589**	...	**55**	**7,742**	**5,053**	**2,911,000**
South Atlantic							
Power Companies	1,040	315	5	113	4,425	1,144	5,624,000
Municipal, State & Power District Systems	67	2	2	22	931	170	301,000
Cooperatives	166	165	...	.....	2,621	1,913	655,000
Federal Agencies	22	10	...	.....	.....	.....	10,000
Total	**1,295**	**492**	**7**	**135**	**7,977**	**3,227**	**6,590,000**
East South Central							
Power Companies	337	202	...	7	1,234	87	2,385,000
Municipal, State & Power District Systems	75	47	...	7	721	284	1,043,000
Cooperatives	125	102	...	.....	2,720	2,176	65,000
Federal Agencies	260	25	...	.....	.....	.....	1,400,000
Total	**797**	**376**	...	**14**	**4,675**	**2,547**	**4,893,000**
West South Central							
Power Companies	1,113	101	3	72	3,266	1,486	4,578,000
Municipal, State & Power District Systems	113	.....	...	5	532	162	438,000
Cooperatives	253	75	...	.....	3,413	2,560	40,000
Federal Agencies	39	.....	...	.....	.....	.....	145,000
Total	**1,518**	**176**	**3**	**77**	**7,211**	**4,208**	**5,201,000**
Mountain							
Power Companies	582	127	1	35	2,109	917	956,000
Municipal, State & Power District Systems	114	60	205	7	456	21	219,000
Cooperatives	323	206	...	.....	2,839	2,754	61,000
Federal Agencies	57	15	...	.....	62	.....	216,000
Total	**1,076**	**408**	**206**	**42**	**5,466**	**3,692**	**1,452,000**
Pacific							
Power Companies	825	139	4	241	3,176	881	2,616,000
Municipal, State & Power District Systems	125	95	20	69	493	84	982,000
Cooperatives	144	.....	...	1	291	247	6,000
Federal Agencies	¶35	.....	...	.....	.....	.....	967,000
Total	**1,229**	**234**	**24**	**311**	**3,960**	**1,212**	**4,571,000**
Total Continental United States							
Power Companies	6,691	1,931	177	2,209	23,550	6,133	29,433,000
Municipal, State & Power District Systems	1,008	461	245	135	4,050	1,349	4,181,000
Cooperatives	2,187	711	...	2	18,049	15,148	1,325,000
Federal Agencies	513	50	...	.....	62	.....	2,971,000
Total	**10,399**	**3,153**	**422**	**2,346**	**45,711**	**22,630**	**37,910,000**
Alaska	34	18	...	2	142	2	19,750
Hawaii	5	12	...	.....	54	.....	4,600
Total United States	**10,438**	**3,183**	**422**	**2,348**	**45,907**	**22,632**	**37,934,350**
U. S. Possessions							
Puerto Rico & Virgin Islands	71	20	1	8	459	427	527,180

Transmission & Distribution Line Construction

Transmission Line Construction



Primary Distribution Line Construction



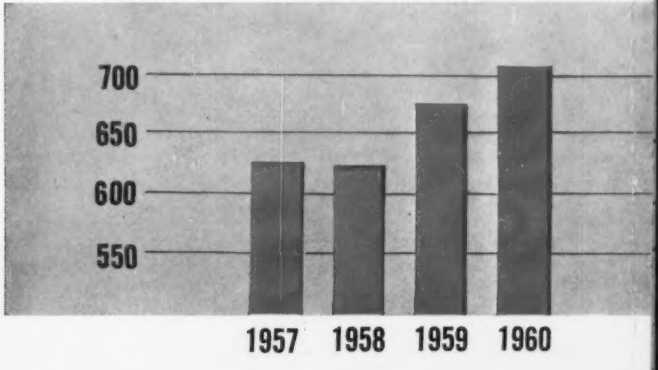
Mileage and Kva

	1957	1958	1959	1960
Transmission Lines — Circuit Miles				
66 kv and above	10,256	9,394	10,573	10,399
22 — 65.9 kv	3,288	3,695	2,838	3,153
Primary Distribution Lines — Pole Miles				
Total	53,017	41,145	43,307	45,711
Rural	32,389	24,522	22,819	22,630
Underground Construction — Cable Miles				
Transmission	252	234	343	422
Distribution	2,563	1,749	2,085	2,346
Substations — Thousands of Kva	37,527	37,354	30,581	37,910

Millions of Dollars

	1957	1958	1959	1960
Transmission Lines				
66 kv and above	261	258	258	289
22 — 65.9 kv	52	45	36	41
Primary Distribution Lines				
Total	449	423	436	435
Rural	113	107	98	89
Underground Construction				
Transmission	33	53	38	10
Distribution	76	54	73	87
Substations	441	412	346	391

Maintenance — Millions of Dollars



$709 Million for 1960 Maintenance

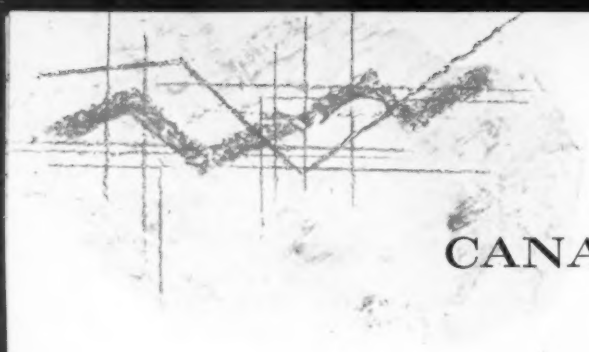
Electric utilities in the continental United States are slated to spend $709 million on maintenance in 1960. This represents a gain of 5.1% or $34 million over last year. Of the total, power companies will spend 81% or $572-million—up 5.4% over 1959.

Other industry groups report spending plans as follows: Municipal, state and power district systems $64 million, up 1.4%; cooperatives $36 million, up 10.2%; and federal agencies $37 million, up 2.1%.

Of the power company maintenance dollar, approximately 39¢ will be spent on generating facilities, 9¢ on transmission plant, 48¢ on the distribution system and about 4¢ on general plant such as office buildings, warehouses, transportation equipment, etc.

Maintenance—Thousands of Dollars

	1959	1960
New England		
Power Companies	38,962	40,703
Municipal, State & Power District Systems	1,944	1,954
Cooperatives	146	175
Federal Agencies	.....	.....
Total	**41,052**	**42,832**
Middle Atlantic		
Power Companies	167,802	182,397
Municipal, State & Power District Systems	773	763
Cooperatives	674	701
Federal Agencies	.....	.....
Total	**169,249**	**183,861**
East North Central		
Power Companies	135,182	136,790
Municipal, State & Power District Systems	6,690	6,756
Cooperatives	3,948	4,224
Federal Agencies	45	50
Total	**145,865**	**147,820**
West North Central		
Power Companies	30,354	31,641
Municipal, State & Power District Systems	11,962	11,327
Cooperatives	6,316	7,074
Federal Agencies	794	734
Total	**49,426**	**50,776**
South Atlantic		
Power Companies	61,342	64,197
Municipal, State & Power District Systems	4,573	3,820
Cooperatives	6,682	7,484
Federal Agencies	653	705
Total	**73,250**	**76,206**
East South Central		
Power Companies	17,070	17,944
Municipal, State & Power District Systems	5,507	6,728
East South Central (continued)		
Cooperatives	7,346	7,860
Federal Agencies	16,352	16,370
Total	**46,275**	**48,902**
West South Central		
Power Companies	36,457	40,271
Municipal, State & Power District Systems	3,684	3,608
Cooperatives	4,578	4,990
Federal Agencies	1,645	1,740
Total	**46,364**	**50,609**
Mountain		
Power Companies	13,918	14,485
Municipal, State & Power District Systems	1,938	2,130
Cooperatives	1,626	1,951
Federal Agencies	4,089	4,206
Total	**21,571**	**22,772**
Pacific		
Power Companies	41,823	43,776
Municipal, State & Power District Systems	25,941	26,791
Cooperatives	976	1,113
Federal Agencies	12,981	13,520
Total	**81,721**	**85,200**
Total Continental United States		
Power Companies	542,910	572,204
Municipal, State & Power District Systems	63,012	63,877
Cooperatives	32,292	35,572
Federal Agencies	36,559	37,325
Total	**674,773**	**708,978**
Alaska	260	428
Hawaii	2,288	2,391
Total United States	**677,321**	**711,797**
U. S. Possessions		
Puerto Rico & Virgin Islands	4,277	4,434



CANADIAN CONSTRUCTION

Spending downturn halted by 2.2% budget boost in '60. Increases of 10.2% in transmission and 12.1% in miscellaneous overcome drag of 1.2% cut in generation.

Canadian electric utilities have budgeted $507 million for new construction in 1960. This is $11 million or 2.2% more than the industry spent last year and marks the first year-to-year increase in capital expenditures since 1957 when utilities poured $644 million into new facilities.

Generation expenditures are slated to drop 1.2% to $257 million following a sharp decline of almost 32% in 1959. As in the past few years hydro plant

	Total Canada	Nfld & P.E.I.	Nova Scotia	New Brunswick	Quebec	Ontario
Electric Plant Construction—Thousands of Dollars						
Fuel 1959	98,569	1,725	2,929	3,500	.....	51,615
1960	109,915	1,225	687	4,000	.....	70,717
Hydro 1959	160,847	1,390	2,078	240	53,000	56,604
1960	147,296	1,000	3,160	100	66,312	36,265
Transmission 1959	97,811	1,017	4,001	3,000	25,022	38,661
1960	107,551	535	6,169	3,500	23,085	40,735
Distribution 1959	105,744	1,636	2,393	2,285	26,895	29,417
1960	105,100	1,378	1,820	2,790	29,426	24,783
Miscellaneous 1959	32,701	50	259	200	16,707	1,794
1960	37,330	133	531	200	29,854	3,408
Total 1959	495,672	5,818	11,660	9,225	121,624	178,091
1960	507,192	4,271	12,367	10,590	148,677	175,908
Maintenance—Thousands of Dollars						
1959	56,572	1,366	4,180	605	11,922	26,323
1960	61,431	1,465	3,729	609	12,732	28,513
Line & Substation Construction—Thousands of Dollars						
Transmission Line						
66 Kv & Up—1959	47,975	92	550	3,034	19,595	11,246
1960	53,398	100	4,400	3,500	16,026	13,075
22–65.9 Kv— 1959	5,364	.....	207	.....	294	3,512
1960	5,858	110	440	.....	584	3,399
Underground						
Transmission 1959	4,499	.....	.....	.....	.....	1,054
1960	3,225	.....	.....	.....	.....	2,525
Distribution 1959	4,340	.....	.....	.....	1,550	548
1960	5,389	.....	10	.....	2,125	574
Primary Distribution Line						
Total 1959	53,575	468	156	1,917	12,088	23,081
1960	49,997	940	171	1,515	12,093	19,904
Rural 1959	32,617	325	150	1,600	1,288	22,489
1960	28,637	770	170	1,300	422	19,012
Substations 1959	47,003	97	747	393	7,184	25,237
1960	42,626	120	751	305	7,605	23,585
Line & Substation Construction						
Transmission Line—Circuit Miles						
66 Kv & Up 1959	2,563	11	43	84	1,251	233
1960	1,596	6	184	136	91	152
22–65.9 Kv 1959	604	.....	42	.....	28	110
1960	516	16	84	.....	58	108
Underground—Cable Miles						
Transmission 1959	34	.....	.....	.....	.....	7
1960	20	.....	.....	.....	.....	14
Distribution 1959	209	.....	.....	.....	89	84
1960	277	.....	1	.....	123	82
Primary Distribution—Pole Miles						
Total 1959	8,963	156	65	78	776	1,057
1960	8,552	263	44	62	556	1,190
Rural 1959	7,528	145	63	65	486	982
1960	7,126	250	43	50	161	1,096
Substation—Thousands of Kva						
1959	7,155	25	150	30	2,375	3,061
1960	5,225	22	110	20	1,841	2,205

First Increase in Three Years Boosts Canada's Budget 2.2% to $507 Million

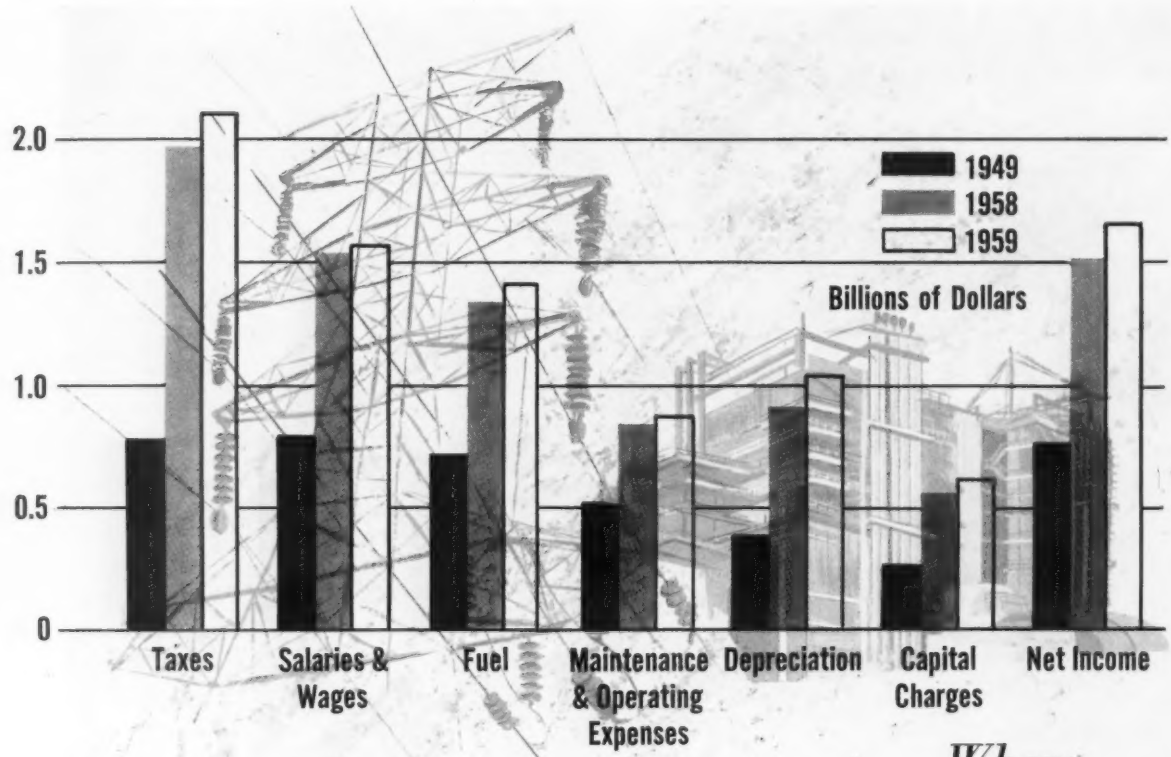
construction will bear the brunt of this cutback by falling $14 million or 8.7% from last year's $161 million. Offsetting the major part of this downturn will be fuel plant expenditures now pegged at $110 million 11.1% higher than in 1959.

In contrast to generation spending, transmission plant expenditures are slated for a 10.2% jump to $108 million—still considerably under the $126 million high of 1958. Distribution construction which holds fairly steadily over the years is scheduled for a negligible drop of 0.9% to $105 million.

Results by province are also quite mixed. Among the big spenders Quebec shows a 22.2% increase to $148.7 million, Ontario indicates a 1.2% dip to $175.9 million, British Columbia is slated for a sharp drop of 21.5% to $63.7 million and Manitoba is down 18.4% to $32.5 million. Alberta and Saskatchewan are up 33.7% and 10.2% respectively.

	Total Canada	Manitoba	Sask-atchewan	Alberta	British Columbia	Yukon & N.W.T.
Electric Plant Construction—Thousands of Dollars						
Fuel 1959	98,569	9,061	10,763	2,616	15,860	500
1960	109,915	6,633	912	4,570	20,671	500
Hydro 1959	160,847	18,107	610	3,113	23,905	1,800
1960	147,296	12,583	9,300	7,006	8,570	3,000
Transmission 1959	97,811	4,956	7,008	4,621	9,375	150
1960	107,551	5,486	9,302	6,332	12,407	.....
Distribution 1959	105,744	7,210	5,212	11,011	19,560	125
1960	105,100	7,162	5,486	10,861	21,294	100
Miscellaneous 1959	32,701	561	.....	746	12,384	.....
1960	37,330	681	1,000	794	729	.....
Total 1959	**495,672**	**39,895**	**23,593**	**22,107**	**81,084**	**2,575**
1960	**507,192**	**32,545**	**26,000**	**29,563**	**63,671**	**3,600**
Maintenance—Thousands of Dollars						
1959	56,572	3,399	943	1,309	6,495	30
1960	61,431	3,749	2,685	1,352	6,547	50
Line & Substation Construction—Thousands of Dollars						
Transmission Line						
66 Kv & Up—1959	47,975	2,245	3,576	1,483	6,004	150
1960	53,398	840	1,925	3,206	10,326	.....
22–65.9 Kv— 1959	5,364	594	749	8	.....	.....
1960	5,858	825	368	132	.....	.....
Underground						
Transmission 1959	4,499	.....	258	745	2,442	.....
1960	3,225	.....	.....	700	.....	.....
Distribution 1959	4,340	136	3	868	1,235	.....
1960	5,389	127	175	1,717	661	.....
Primary Distribution Line						
Total 1959	53,575	290	2,742	5,093	7,615	125
1960	49,997	409	2,675	4,971	7,219	100
Rural 1959	32,617	248	2,131	2,578	1,808	.....
1960	28,637	170	2,112	2,081	2,600	.....
Substations 1959	47,003	1,509	1,386	3,829	6,618	3
1960	42,626	2,516	898	3,481	3,249	116
Line & Substation Construction						
Transmission Line—Circuit Miles						
66 Kv & Up 1959	2,563	147	414	205	165	10
1960	1,596	74	329	376	248	.....
22–65.9 Kv 1959	604	126	297	1	.....	.....
1960	516	67	132	51	.....	.....
Underground—Cable Miles						
Transmission 1959	34	.....	4	8	15	.....
1960	20	.....	.....	6	.....	.....
Distribution 1959	209	5	1	4	26	.....
1960	277	5	28	16	22	.....
Primary Distribution—Pole Miles						
Total 1959	8,963	152	3,298	2,827	529	25
1960	8,552	180	3,256	2,378	603	20
Rural 1959	7,528	148	3,020	2,436	183	.....
1960	7,126	175	3,010	1,981	360	.....
Substation—Thousands of Kva						
1959	7,155	142	434	357	580	1
1960	5,225	173	265	341	230	18

Net Income Hits Record High of $1,670 Million in '59



Where Power Company Income Went

Electric Rate Increases

	GRANTED		PENDING		
	Number	Dollars	As of Dec. 31	Number of Applications	Dollars
1951	27	32,900,000	1951	32	75,700,000
1952	46	76,700,000	1952	21	44,400,000
1953	27	21,000,000	1953	22	62,700,000
1954	21	54,200,000	1954	16	37,600,000
1955	19	25,500,000	1955	8	10,500,000
1956	7	6,700,000	1956	11	35,100,000
1957	13	58,500,000	1957	20	68,000,000
1958	22	76,000,000	1958	31	100,300,000
1959*	25	54,300,000	1959*	27	86,800,000

* Preliminary.

Total electric revenues for 1959 for investor-owned electric utilities were up 7.9% over the record-breaking year of 1958. All major classifications showed increases. Rate hikes helped. They amounted to about $54 million and were placed in effect at various times during the year. Net income continued its upsurge, totaling $1,670 million, a 10.2% hop over the previous year.

Operating expenses were also on the rise and amounted to 42.3¢ of every revenue dollar. Salaries and wages took 17.1¢, fuel registering 15.5¢. Maintenance and other operating expenses dipped slightly and totaled 9.7¢ in 1959 compared with 10.4¢ in 1958.

With gross utility plant of investor-owned utilities increasing 8.1% over 1958, depreciation charges went over billion-dollar mark for first time, reaching $1,050 million.

Taxes continued to be the largest expense in the income statement of these companies. They accounted for 23.2¢ of every revenue dollar and hit a record $2,120 million.

Gross corporate income was up 11.1%, net income 10.2%. Dividends on both preferred and common stocks will be up about 9.7%, jumping to $1,225 million. After deducting this from a record $1,670 million in net income, investor-owned electric utilities will have around $445 million to transfer to surplus for use in helping to take care of the $3.4 billion construction budget expected in 1960.

Total assets of Class A and B companies will total around $42.4 billion in 1959. Gross utility plant will aggregate about $47 billion.

Security sales, as reported by the Irving Trust Co, totaled $1,904 million in 1959, 17.9% less than the $2,321 million shown in the previous year. All the money raised in 1959 was "new money" financing. Debt financing was off from 1958, but common and preferred stock financing jumped from $554 million to $641 million.

Bond and stock yields were on the increase during the year. Moody's "Aaa" public utility bond yields went from 4.19% in December, 1958 to 4.67% by December, 1959. Moody's 24 public utility common stocks hopped from 3.87% in December, 1958, to 4.01% in December, 1959.

Composite Year End Balance Sheet

(Millions of Dollars)

Class A and B Electric Utility Companies

	1959*	1958	1957	1956
Assets				
Electric Plant and Adjustments	42,750	39,264	35,998	32,762
Other Utility Plant and Adjustments	4,250	4,221	3,993	3,684
Total Utility Plant	47,000	43,485	39,991	36,446
Reserves for Depreciation and Amortization of Utility Plant	9,000	8,203	7,570	6,962
Total Utility Plant Less Reserves	38,000	35,282	32,421	29,484
Investment and Fund Accounts	1,030	1,008	979	937
Current and Accrued Assets	2,800	2,772	2,799	2,617
Deferred Debits	225	215	202	203
Capital Stock Discount and Expenses	85	78	74	70
Reacquired Securities	30	29	23	29
Total Assets	**42,170**	**39,384**	**36,498**	**33,340**
Liabilities				
Capital Stock				
Preferred	4,100	4,023	3,774	3,686
Common	8,600	8,050	7,660	7,248
Premium on Capital Stock	1,250	1,213	1,053	943
Total Capital Stock	13,950	13,286	12,487	11,877
Long Term Debt				
Bonds	19,400	18,113	16,586	14,770
Other	500	466	465	460
Total Long Term Debt	19,900	18,579	17,051	15,230
Current and Accrued Liabilities	2,800	2,781	2,804	2,627
Reserves (except those deducted above)	102	101	99	104
Deferred Credits	180	167	155	154
Contributions in Aid of Construction	165	151	137	122
Accumulated Deferred Taxes on Income	1,200	920	695	483
Surplus				
Earned	3,500	3,042	2,718	2,414
Capital	373	357	352	329
Total Surplus	3,873	3,399	3,070	2,743
Total Liabilities	**42,170**	**39,384**	**36,498**	**33,340**
Balance Sheet Ratios				
Reserve for Depreciation Percent of Utility Plant	19.0	18.9	18.9	19.1
Current Assets Times Current Liabilities	1.0	1.0	1.0	1.00
Long Term Debt				
Percent of Gross Utility Plant	42.3	42.7	42.6	41.8
Percent of Net Utility Plant	52.4	52.7	52.6	51.7

* 1959 estimated by "Electrical World."

Source: Federal Power Commission.

Security Sales by Electric Companies

(Thousands of Dollars)

	Bonds, Debentures, etc.		Stocks,		Distribution of Security Sales		
	Public Investors	Institutional Investors	Common and Preferred	Total Financing	New Capital	Refunding	Total Issues
1943	329,300	26,850	14,912	371,062	9,921	361,141	371,062
1944	851,743	103,950	62,535	1,018,228	15,587	1,002,641	1,018,228
1945	1,113,603	121,051	127,268	1,361,922	39,699	1,322,223	1,361,922
1946	633,966	64,040	384,441	1,082,447	172,846	909,601	1,082,447
1947	1,039,517	153,159	384,699	1,577,375	567,729	1,009,646	1,577,375
1948	996,641	156,525	297,460	1,450,626	1,314,456	136,170	1,450,626
1949	959,978	192,280	640,953	1,793,211	1,444,826	348,385	1,793,211
1950	838,108	278,389	591,340	1,707,837	1,300,040	407,797	1,707,837
1951	778,308	110,696	552,943	1,441,947	1,432,257	9,690	1,441,947
1952	929,167	145,860	630,652	1,705,679	1,693,514	12,165	1,705,679
1953	973,075	217,022	766,594	1,956,691	1,938,815	17,876	1,956,691
1954	1,379,885	184,063	784,469	2,348,417	1,761,154	587,263	2,348,417
1955	871,173	130,298	538,927	1,540,398	1,409,415	130,983	1,540,398
1956	911,145	54,616	518,227	1,483,988	1,479,987	4,001	1,483,988
1957	1,687,820	338,667	553,344	2,579,831	2,559,234	20,597	2,579,831
1958	1,701,683	65,393	554,081	2,321,157	2,209,219	111,938	2,321,157
1959	1,178,820	84,150	641,596	1,904,566	1,904,566	.....	1,904,566

Source: Irving Trust Co.

Power Companies Income Statement— Millions of Dollars

	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
Total Electric Revenue	3,886	4,113	4,510	5,005	5,426	5,940	6,317	6,934	7,521	8,054	8,478	9,150
Operating Expenses	2,019	2,030	2,158	2,400	2,577	2,801	2,880	3,076	3,353	3,635	3,713	3,875
Depreciation	364	389	438	475	513	565	634	705	776	835	914	1,050
Total Expenses	2,383	2,419	2,596	2,875	3,090	3,366	3,514	3,781	4,129	4,470	4,627	4,925
Electric Operating Income before Taxes	1,503	1,694	1,914	2,130	2,336	2,574	2,803	3,153	3,392	3,584	3,851	4,225
Taxes	712	794	948	1,150	1,224	1,339	1,442	1,641	1,766	1,858	1,980	2,120
Electric Operating Income after Taxes	791	900	966	980	1,112	1,235	1,361	1,512	1,626	1,726	1,871	2,105
Other Income[1]	118	132	147	154	166	149	181	188	201	210	194	190
Gross Corporate Income	909	1,032	1,113	1,134	1,278	1,384	1,542	1,700	1,827	1,936	2,065	2,295
Capital Charges[2]	243	267	282	311	322	343	396	443	481	509	550	625
Net Income	666	765	831	823	956	1,041	1,146	1,257	1,346	1,427	1,515	1,670
Dividends	501	566	625	658	732	788	876	952	1,032	1,080	1,117	1,225
Surplus	165	199	206	165	224	253	270	305	314	347	398	445

Source: Federal Power Commission and Edison Electric Institute for the figures shown from 1948 to and including 1957; Edison Electric Institute for the actual figures for 1958, and Edison Electric Institute and Electrical World for estimated 1959. [1] Includes revenues of gas, water, and steam departments and interest on securities held. [2] Includes amortization, interest on long term debt, etc.

Distribution of the Electric Revenue Dollar— Percent

	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
Fuel	20.0	17.2	16.8	17.2	16.9	17.1	15.7	15.9	16.1	17.1	15.8	15.5
Salaries and Wages	21.2	21.1	20.7	20.5	20.0	19.6	19.4	18.1	17.9	17.7	17.6	17.1
Maintenance and Other Operating Expenses	10.8	11.1	10.4	10.2	10.5	10.5	10.5	10.3	10.6	10.3	10.4	9.7
Operating Ratio	52.0	49.4	47.9	47.9	47.4	47.2	45.6	44.3	44.6	45.1	43.8	42.3
Depreciation	9.4	9.5	9.7	9.5	9.5	9.5	10.0	10.2	10.3	10.4	10.8	11.5
Taxes	18.3	19.3	21.0	23.0	22.6	22.5	22.8	23.7	23.5	23.1	23.4	23.2
Electric Operating Income Before Taxes	38.6	41.1	42.4	42.6	43.1	43.3	44.4	45.5	45.1	44.5	45.4	46.2
After Taxes	20.3	21.8	21.4	19.6	20.5	20.8	21.6	21.8	21.6	21.4	22.0	23.0

Source: Federal Power Commission and Edison Electric Institute for the figures shown from 1948 to and including 1957. Edison Electric Institute for the actual figures for 1958 and Edison Electric Institute and Electrical World for estimated 1959.

Coverage of Electrical World's 1959-1960 Survey

	Percentage of Group Reporting on Basis of		Group's Share of U. S. Total	
	Capacity	Customers	Capacity	Customers
Power Companies	99.1%	97.9%	75.9%	79.1%
Municipal, State and Power District Systems	72.0%	58.8%	9.1%	13.0%
Cooperatives	67.4%	32.2%	0.7%	7.9%
Federal Agencies	100.0%	0.0%	14.3%	0.0%
All Groups	96.5%	87.6%	100.0%	100.0%

Determine Series Reactance

W. J. PITCHER, Planning Engineer, System Planning Engineering Dept, Dayton Power and Light Co, Dayton, Ohio.

To preserve accuracy in the higher base voltages, the scale of %X has been divided into two scales, as has the scale of base voltage. The base voltage scale at left (D_1) is used with the %X scale at left (E_1). The base voltage scale at right (D_2) is used with the %X scale at right (E_2).

Draw a line from phase wire size and stranding (Scale A) through the delta spacing on Scale C. Draw another line from where the first line crosses X (Scale B) through the base voltage (Scale D_1 or D_2) extending it to the reactance scale (Scale E_1 or E_2). Read per cent reactance on Scale E_1 or E_2 respectively.

Example 1.
477 MCM ACSR 18 x 1 at 8.42 ft spacing
69 kv X = 1.465 %/mile

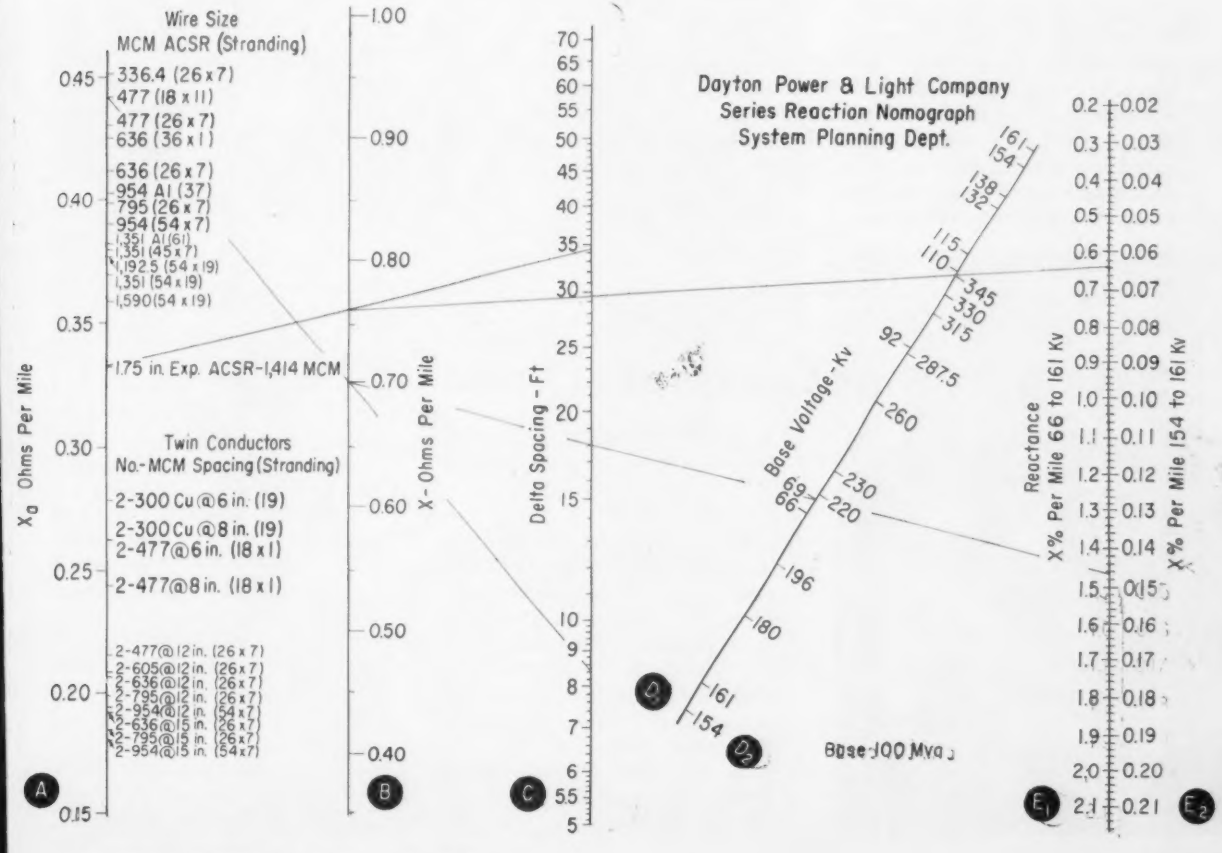
Example 2.
1.75-in. expanded ACSR, 1,414 MCM at 34.5 ft spacing
345 kv X = 0.064 %/mile

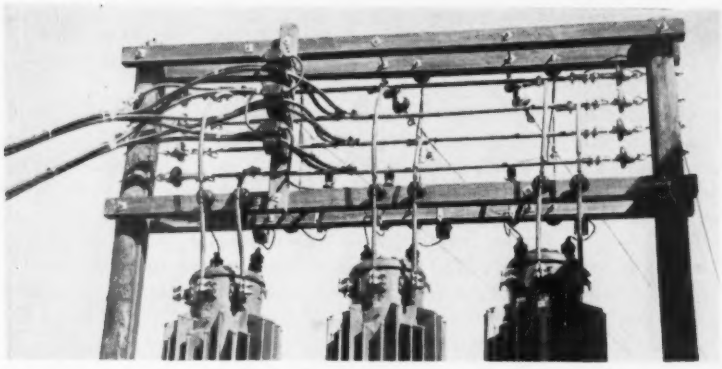
Different wire sizes can be added by calculating X_a and plotting wire size opposite X_a on Scale A.

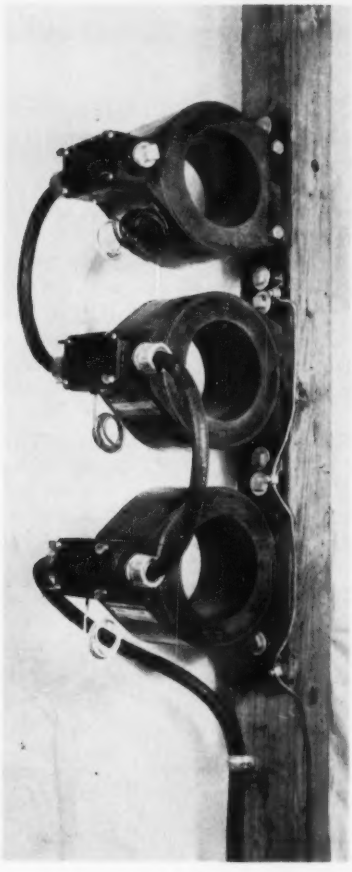
Different base voltages may be added by calculating multiplier, ohms to %, = base kva/10 $(kv)^2$. Draw straight line from 1.00 on X ohm/mile scale (Scale B) to the multiplier on the %X scale (Scale E_1 or E_2). Where this line crosses base voltage scale (D_1 or D_2) insert the voltage. If the multiplier is on Scale E_1, place voltage on Scale D_1. If the multiplier is on Scale E_2, place voltage on Scale D_2.

Note: Both multiplier and ohms/mile may be multiplied or divided by the same number for convenience in plotting.

Reference: "Nomography"—A. S. Levens, John Wiley & Sons, 1948.


Dayton Power & Light Company
Series Reaction Nomograph
System Planning Dept.
Wire Size
MCM ACSR (Stranding)
336.4 (26 x 7)
477 (18 x 11)
477 (26 x 7)
636 (36 x 1)
636 (26 x 7)
954 Al (37)
795 (26 x 7)
954 (54 x 7)
1,351 Al (61)
1,351 (45 x 7)
1,192.5 (54 x 19)
1,351 (54 x 19)
1,590 (54 x 19)
1.75 in. Exp. ACSR-1,414 MCM
Twin Conductors
No.-MCM Spacing (Stranding)
2-300 Cu @ 6 in. (19)
2-300 Cu @ 8 in. (19)
2-477 @ 6 in. (18 x 1)
2-477 @ 8 in. (18 x 1)
2-477 @ 12 in. (26 x 7)
2-605 @ 12 in. (26 x 7)
2-636 @ 12 in. (26 x 7)
2-795 @ 12 in. (26 x 7)
2-954 @ 12 in. (54 x 7)
2-636 @ 15 in. (26 x 7)
2-795 @ 15 in. (26 x 7)
2-954 @ 15 in. (54 x 7)
X_a Ohms Per Mile
X - Ohms Per Mile
Delta Spacing - Ft
Base Voltage - Kv
Reactance
X% Per Mile 66 to 161 Kv
X% Per Mile 154 to 161 Kv
Base 100 Mva
A
B
C
D_1
D_2
E_1
E_2





Shop-Assembled CT's Cut Installation Time

GLEN BAKER, Meterman,
KARL SCHLINGERMAN, Installer,
Ohio Power Co, Newark, Ohio

Shop assembly of sets of CT's for the larger primary metering applications saves time and simplifies the installation of equipment in the field for Ohio Power Co. This method has saved an estimated $500 annually in construction labor costs for the company's Southern Division.

The CT's are assembled on a length of standard crossarm, with control cable and ground wire connections attached, in the meter shop. On the job the assembled unit is raised to the point of use with a hand line, thereby saving 10 man-hr of pole-top assembly time.

The scheduling of time in the shop allows for CT assemblies to be made during periods of inclement weather.

Sawdust Stops Condenser Leak

A. J. DESTAFANO, Plant Hagood,
South Carolina Electric & Gas Co,
Charleston, S. C.

Sawdust injected into the condenser cooling water when a small tube leak appears prevents load drop at peak operating periods of Plant Hagood of the South Carolina Electric & Gas system. The vacuum which surrounds the condenser tubes pulls the sawdust in the cooling water into the tube hole. This plugs the leak until a more convenient time when repair can be made.

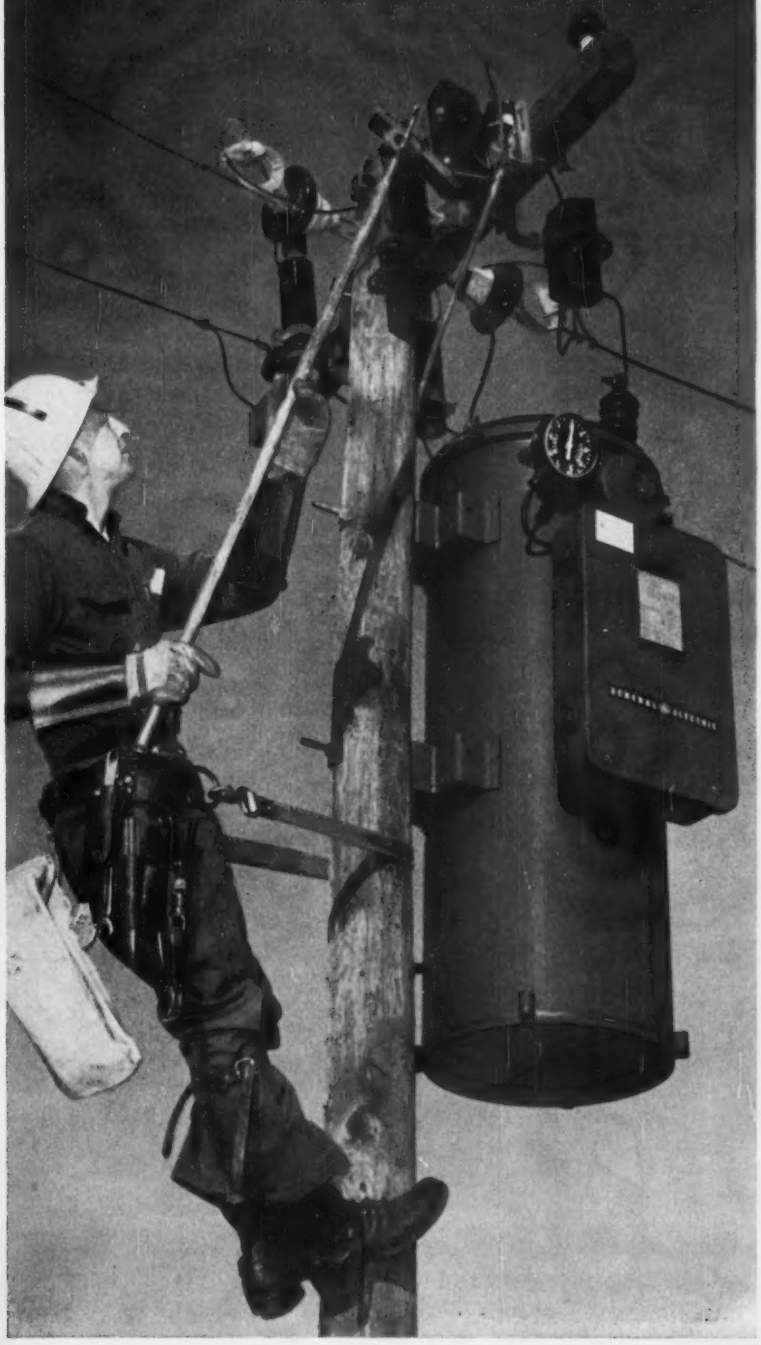
The sawdust injector consists of a light-weight stainless steel tank equipped with quick connecting type couplings for water inlet and outlet. It was devised and fabricated by Plant Hagood maintenance personnel. Sawdust is placed in the tank and the injector water outlet is connected to the condenser cooling water system.

The injector water inlet then is connected by hose to the plant service water system. The higher pressure of this system forces the sawdust from the injector into the condenser cooling water.

(*More Methods on page* 90)

ANOTHER STEP AHEAD IN VOLTAGE REGULATION

POSITIVE NEUTRAL INDICATION



NEW

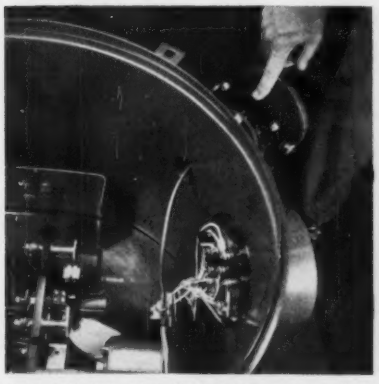
Mark-II position indicator for G-E voltage regulators protects lineman and equipment

Exclusive Mark-II Load Bonus position indicator and indicator drive system for General Electric single-phase step voltage regulators provide positive indication of tap-switch position. This gives more assurance against fear of injury to personnel or equipment when bypassing regulators on hot lines.

Linemen are aware that if a regulator is bypassed with the tap-switch off neutral position, the dead short created across part of the series winding can destroy equipment and seriously endanger the lineman.

It is important that operating personnel *know* that regulators are in the neutral position before bypassing. The new General Electric Mark-II Load Bonus position indicator provides this assurance.

New Mark-II position indicator system—standard on all G-E ML-32 regulators at no price premium—is an example of General Electric's continuing leadership in voltage regulators. This is another reason why G-E regulators cost less on the line. Ask your regulator representative for more information. General Electric Company, Schenectady 5, New York. 423-43



NEW MARK-II INDICATOR drive system eliminates possibility of indication error. Unique locking coupling and gear-driven indicator assure positive alignment of indicator hand and tap-switch position.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Now... 2 new medium transformer products

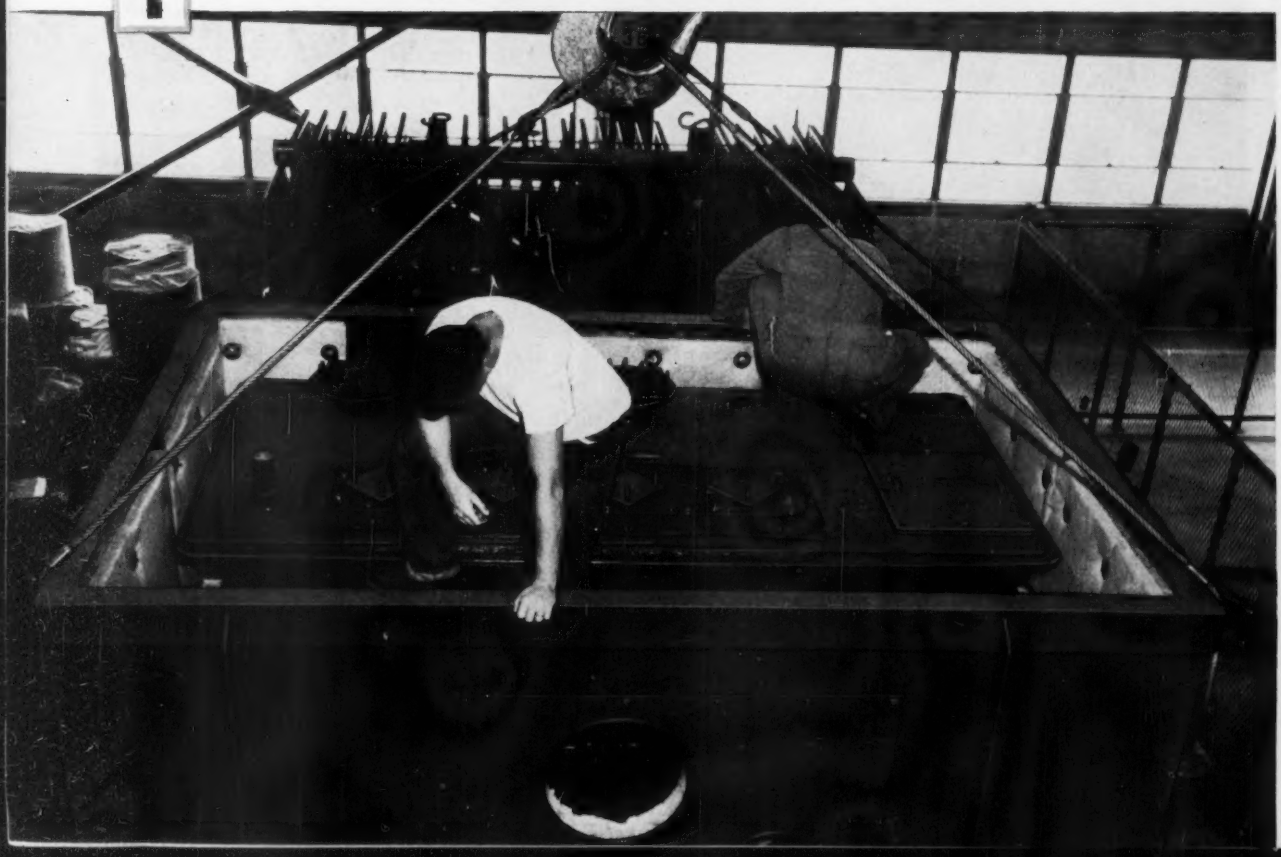
Sound level reductions of almost 20 db and a new low-cost, easily installed substation are making transformer news at General Electric. Lowest sound levels yet for medium* transformers are now available with G.E.'s new pre-fabricated enclosure (also known as "double-wall tank"). And, the reliable General Electric super-compact substation mounts all of the necessary reclosers, lightning protection, fuses, and metering equipment on the medium transformer. Here is what these new products mean to you . . .

PRE-FABRICATED ENCLOSURE. Solving the ever-present problem of transformer hum in residential substations has long been the aim of General Electric transformer engineers. Construction of sound barriers or the use of low-sound transformers often have proved unsatisfactory or too costly. A significant development has resulted from General Electric research in the form of the pre-fabricated enclosure. By placing a pre-fabricated outer tank over a transformer with separately banked radiators, sound level reductions up to 20 db have been achieved.

SUPER-COMPACT SUBSTATION. Reliable, low-cost, easily installed, this G-E unit is the most economical substation for use in thinly populated suburban areas. The G-E super-compact substation has a low-voltage circuit arrangement which is more consistent with normal sub-

* 501 to 7500 kva, 69 kv and below.

1 PRE-FABRICATED ENCLOSURE



from General Electric

station arrangement and application and requires a minimum of adjacent structure. A super-compact substation can be built around any G-E medium transformer.

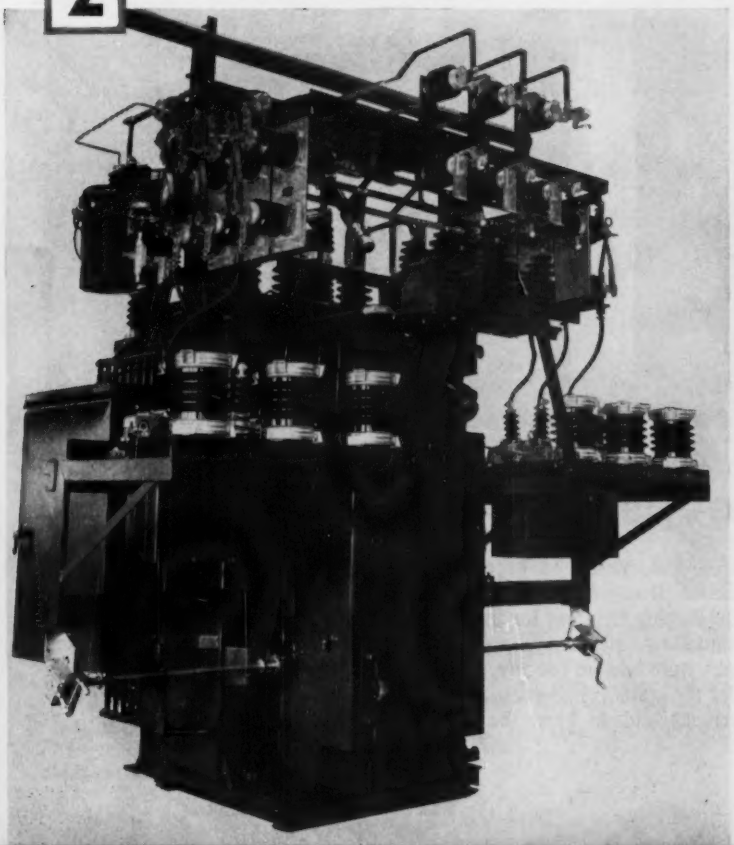
Product leadership is just part of our story. General Electric medium transformers are certified to deliver **full value** for your transformer dollar . . . in terms of superior products . . . plus faster order handling and shipment . . . plus complete service before, during, and after installation. When deciding on your next medium transformer, examine the **complete "package"** offered by General Electric. When you do, we're confident you'll recognize G-E superiority and how you get full value for your transformer dollar.

For information or application help on General Electric Certified Full-value medium transformers, see your G-E Apparatus Sales Engineer. General Electric Co., Schenectady 5, N. Y. 416-24

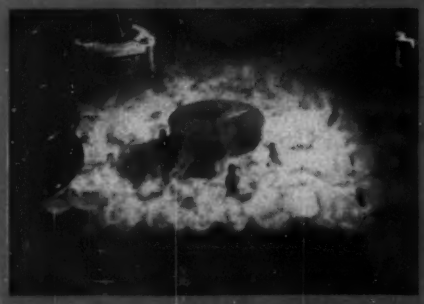
Progress Is Our Most Important Product

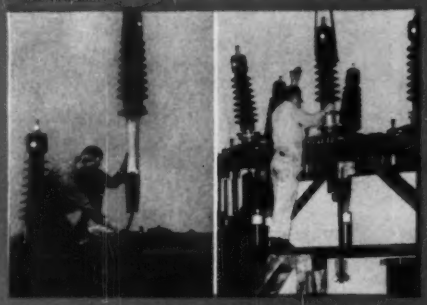
GENERAL ELECTRIC

2 SUPER-COMPACT SUBSTATION



FULL VALUE FOR YOUR TRANSFORMER DOLLAR

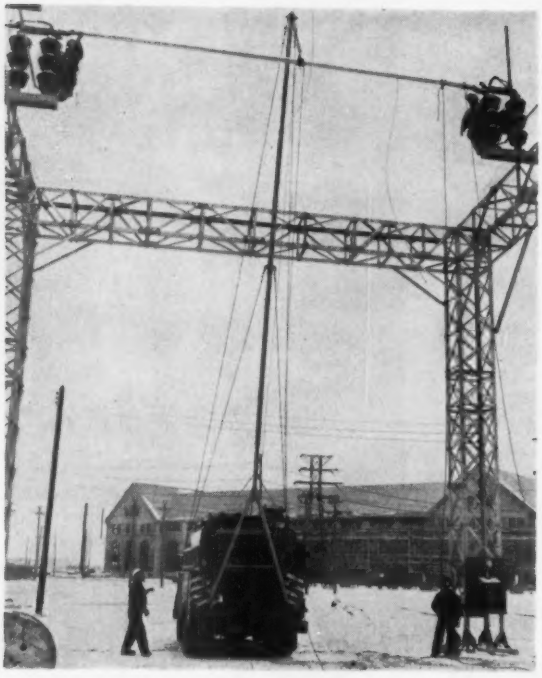




SUPERIOR DESIGN, FEATURES, AND PERFORMANCE of G-E transformers is typified by new pressure-relief device (above) and interchangeable transformer-circuit breaker bushings (below).

FASTER SHIPMENT through rapid processing of orders . . . computer design capability . . . repetitive manufacturing facilities.

COMPLETE SERVICE . . . application and systems engineers . . . installation engineers . . . of 50 conveniently located service shops.



High Lift Hoist Aids Substation Work

A high lift hoist, for substation repair and maintenance, was designed by Marvin Wynn, electric foreman at Niagara Mohawk Power Corp. Built in the local company shop, it is fabricated of high-strength tubular steel for maximum strength. The hoist has a capacity for safe lifts of 500 lb.

The hoist, which extends to 36 ft, is primarily for transmission substation construction and repair. It can handle insulators, bushings, bus components, small disconnect switches and any parts weighing up to 500 lb.

For use in the field, the base of the hoist is connected to the standard truck A-frame fittings. The hoisting line is attached to the winch, which is powered by the truck engine and controlled from the driver's position in the cab. When disassembled the hoist parts become a compact package, for convenient storage or easy transportation in regular electric department vehicles.

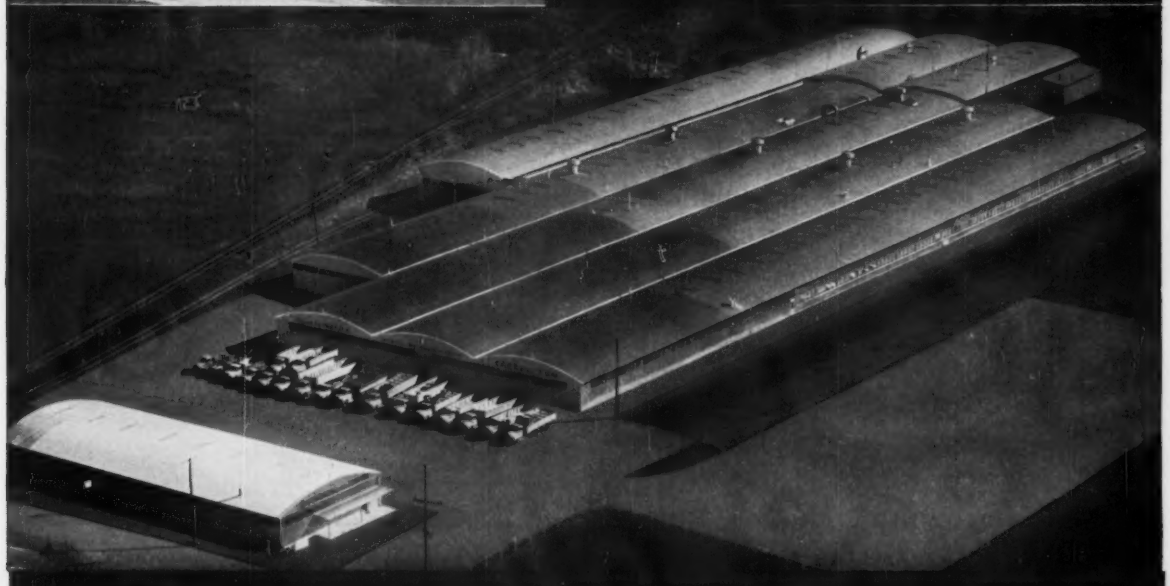
Wood Planking Keeps Digger From Sliding

LEONARD J. MATONIC, Underground Lines, Detroit Edison Co, Detroit, Michigan

Protective pieces of wood planking have been fastened to the stabilizer blade of the Hydra-Hoe by the Underground Dept of Detroit Edison Co to keep the machine from sliding forward while digging trenches for underground lines. Formerly, separate planks were laid on the pavement under the stabilizer to protect the pavement and to keep the machine from moving. These planks had to be moved by hand each time the machine was moved. Having planks fastened to the stabilizer saves time and gives greater assurance that the pavement will not be damaged.

THEN .. and NOW

Since 1950, Southwire has grown from 10,000 to 250,000 square feet—an independent wire and cable manufacturer with skilled manpower to match the most modern equipment available.



SOME THINGS NEVER CHANGE AT SOUTHWIRE

Sure, a fellow may have to walk a little farther from his car to the plant, or use the telephone to get information instead of stepping into the next office for it — but at heart we're still a small plant in a small town, waiting anxiously for each order and eagerly watching its progress through the mill with care and pride.

We're still Jim, and Jack, and Dave, and Pete—to our customers and to each other. The order for a thousand pounds of copper wire is still important to us. And it gets the same personal attention as one for a million and a half pounds of ACSR transmission cable.

True, constantly expanding product lines, larger and more modern facilities, and continuing research programs, are added reasons for doing business with SOUTHWIRE . . . but personal attention, dependable service, and quality products, are the things that have built our business and will continue to make SOUTHWIRE a good place to trade.

SOUTHWIRE serves the world

Southwire® Company

TErrace 2-6311 CARROLLTON, GEORGIA

• Bare and Weatherproof Copper and Aluminum Line Wire • Neoprene, Polyethylene, and VWP (Vinyl) Weatherproof Copper Aluminum and Triplex • U.R.C. (DBWP, TBWP) Copper • Copperweld® Conductors • Copper and Aluminum Building Wire • ACSR and All Aluminum Cable • Galvanized Steel Guy Strand and Static Wire • Aluminized Steel Guy Strand and Static Wire • Aluminum Alloy Wire • Cable Accessories • NM Sheathed Cable

ALSO FABRICATORS OF COPPER AND ALUMINUM FOR WIRE AND CABLE MANUFACTURERS

Procurement & Products

MEETING **Public Utility Buyers Group meeting in Atlanta next week** will discuss such pertinent topics as pricing structures, steel and substitute materials, and capital equipment purchases. George H. Cole, manager of purchases for Alabama Power Co, will talk on "Artificiality of Pricing Structures." C. W. Mills, manager of electric utility sales for Westinghouse Electric Corp, will talk on "Obtaining Value for Your Electric Utility Dollar."

"Purchasing's role in capital equipment buying" is topic of talk to be given by Mark B. Covell, Union Electric Co, at the Atlanta meeting. William S. Ginn, General Electric Co vice president, will discuss "Scheduling and Pricing Problems—Heavy Electrical Equipment." Chet F. Ogden, vice president of Detroit Edison Co, will elaborate on the Business Survey of the National Association of Purchasing Agents.

PRICES ▶ **Line Material Industries announces 10% price reduction** on 20/34.5-kv grounded wye distribution transformers rated 500-kva and below. The reduction is to encourage greater application of 20/34.5-kv distribution systems, says A. R. Waehner, director of transformer product sales. The reduction applies to transformers on order and shipped on or after Jan. 14.

PROBE ▶ **Philadelphia Grand Jury investigating pricing policies** in the electrical manufacturing field is expected to wind up its work by late February. If it finds "probable cause to believe the law has been violated," it will hand down indictments at that time.

FLEET ▶ **Helicopter is purchased by Southern California Edison Co**, among the very first of the power companies to make such an acquisition. At the time of purchase the utility was buying some 30 hours of chartered helicopter time each month for such jobs as powerline patrol and its annual snow survey. With the acquisition of the new plane, the utility intends to explore additional uses for it, hoping to find additional economies.

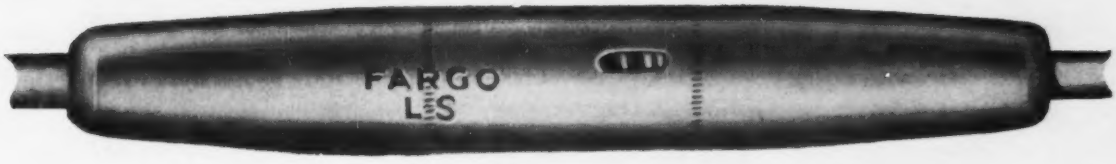
DELIVERY ▶ **"SPALT" spells "Special Attention" at Royal Electric** Manufacturing Co, makers of power switching equipment and special devices. With the "SPALT" label attached to a recent rush order, the firm was able to engineer and manufacture three bushing terminals and ship them in just 16 working hours. All Royal workers have been alerted to the special demands of the "SPALT" rush order label.

News of Manufacturers ..... page 94
New Equipment ..... page 105
Readers Service ..... page 112

when weather's rough and time short...

USE FARGO'S

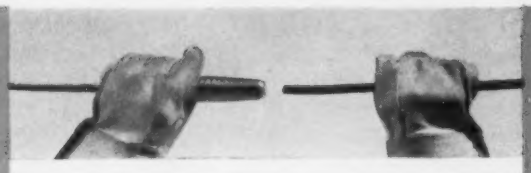
AUTOMATIC SPLICE

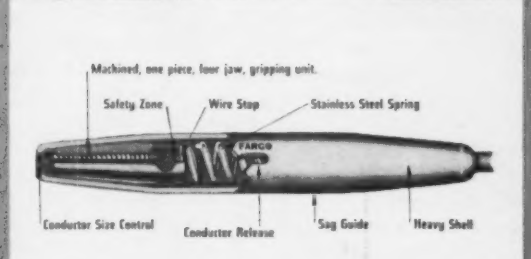


FIT RIGHT!
WORK RIGHT!
EVERY TIME!

When the weather is against your linemen . . . when customers need service fast . . . use FARGO AUTOMATIC SPLICES. Under any conditions, the *"automatic"* works right and you can always depend on it. Even sagging is easier . . . each splice is marked with a sag guide.

Get set right now for that hectic weather ahead. Permanent automatic splices are installed without tools . . . and they are reusable.





details make the difference!

The exclusive FARGO accurately machined "one piece" jaw design assures perfect alignment of the jaw segments for a better conductor grip. Fargo *"automatics"* are available for copper, aluminum, aluminum alloy, and high strength messenger in a wide range of conductor sizes.

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LINE MATERIAL INDUSTRIES
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Poughkeepsie
New York
FARGO

Preformed Line-Fanner Suits Are Dismissed

Action involved alleged infringement on short pitch armor rods and dead ends and claims for relief by the firms

Patent infringement suits brought by Preformed Line Products Co against Fanner Mfg Co on short pitch armor rods and dead ends have been dismissed by a Federal District Court judge in Cleveland. The court also dismissed Fanner's counterclaim for damages.

It is not known whether Preformed will appeal.

Background of the suits dates to 1936 when Thomas F. Peterson, president and principal stockholder of Preformed, filed a patent application for helical preformed reinforcements used in combination with line conductors (the preformed armor rod). The patent was granted in 1942 and Peterson first licensed Fanner to make the armor rod in 1944. In 1947 the license agreement was broadened to include Peterson's application for a second patent covering armor rod.

But claimed deficiencies in design were discovered, prompting Peterson in 1948 to file a third application which in 1952 matured into the "short pitch" patent, which was one of the patents in contest. Peterson claimed that Fanner was not licensed under the "short pitch" patent.

In the meantime, Peterson in 1946 filed a fourth patent application, which in 1956 was granted for a preformed dead end. Peterson claimed that Fanner was not authorized to make dead ends—a claim which Fanner contested.

The suit hinged on the claimed infringement of the "short pitch" and "dead end" patents.

In the ruling handed down Jan. 6, Judge Charles J. McNamee:

- Dismissed the infringement claim on the short pitch patent, ruling that the short pitch feature was not sufficiently different to make that patent a valid one.
- Ruled that should the short pitch patent be considered valid, Preformed had implicitly licensed Fanner to use it by accepting armor rod royalties from Fanner all during the time Fanner had been making only the short pitch variety.
- Held the dead end patent valid and said Fanner had infringed upon it, but ruled that Preformed had misused its dead end patent after it was granted in 1956. The misuse of this patent, the judge ruled required him to deny all of Preformed's claims in this particular action. He said the denial of relief will continue until Preformed "is able to show that it has wholly abandoned its improper practices and that the consequences of such practices are fully dissipated.
- Dismissed Fanner's counterclaim for damages because Fanner did not establish to the satisfaction of the court "the fact of damages."
- Held he did not have the jurisdiction to rule on Preformed's cross-charges of unfair competition.

Daystrom Reports LP&L Computer Has 99.75% Availability

The computer and data-logging equipment, designed, built and installed at Louisianna Power & Light Co's Sterlington station near New Orleans by Daystrom, Inc, has achieved 99.75% availability in a six-month test. No time was lost because of the failure of the computer which is the heart of the system, although some 4,000 transistors and 7,500 diodes were involved in the system.

It operated virtually 24 hours a day for the past six months and attained a degree of reliability never before realized in industrial operation, said Daystrom spokesmen at a recent press conference held by their company to announce test results.

The Sterlington computer was installed for operational information at the plant in March, 1958, the first such system in the electrical industry. The six-month test ended at midnight January 4, 1960.

Elimination of moving parts and replacement of electronic tubes with solid state components such as transistors are the key factors responsible for the high degree of reliability of the eqnipment, according to Daystrom's President Thomas Roy Jones.

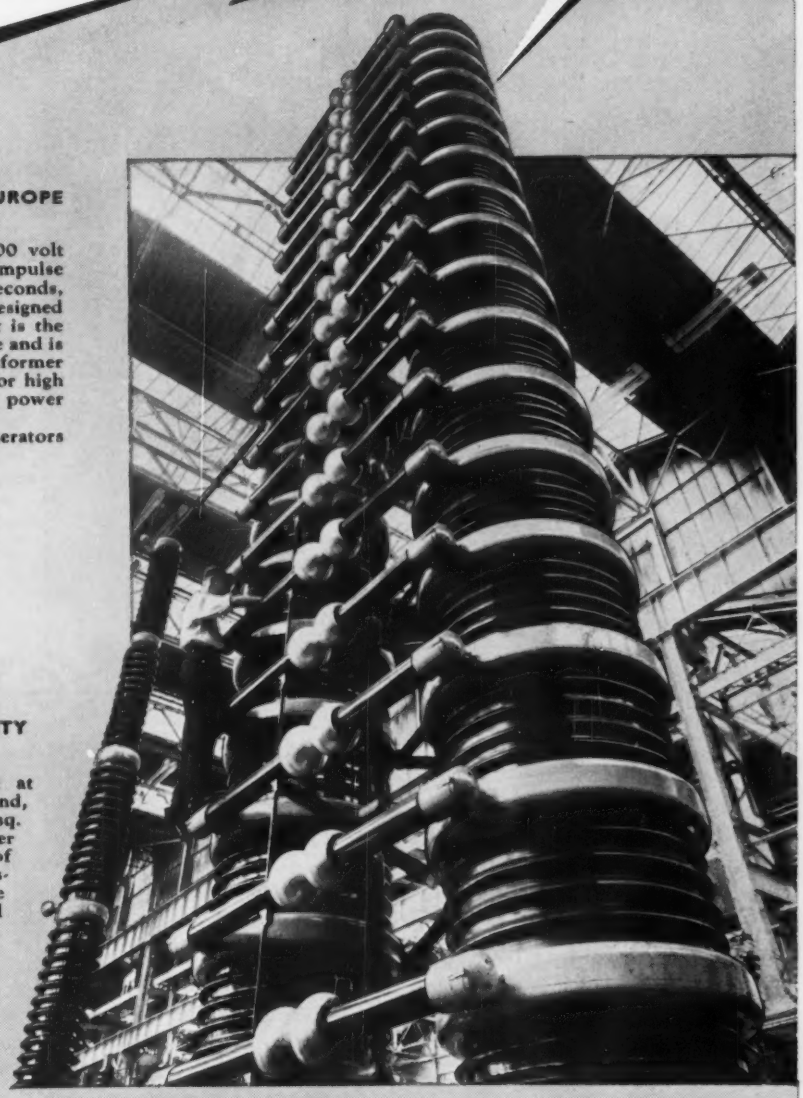
When making negotiations for the Sterlington computer contract, Daystrom guaranteed the system to operate better than 99% of the time, 24 hours a day, 7 days a week. Louisiana P&L records disclose that the equipment actually bettered the guarantee. Daystrom was the first manufacturer to make such a guarantee for a computer system.

"The few times that the equipment was out of service, maintenance personnel found that the trouble was in accessory equipment, not in the computer, says Jones.

W. T. Hess, Louisiana P&L's vp and chief engineer, observed that the system first logged essential data for the men operating the Sterlington plant, and, almost simultaneously, reduced these data and developed information from them so that they could more effectively use the equipment under their control. The system, he said, does six things: (1) Automatically monitors 350 points involving tem-

(*Continued on page 96*)

4,000,000 VOLTS!



THE LARGEST
IMPULSE GENERATOR IN EUROPE

The illustration shows a 4,000,000 volt 18 stage, 2 column Ferranti Impulse Generator, energy rating 285 kW seconds, D.C. charging 220 kV per stage. Designed and built by Ferranti engineers, it is the largest impulse generator in Europe and is now installed in the Ferranti Transformer Factory at Hollinwood, England for high voltage impulse testing of large power transformers.
Ferranti High Voltage Impulse Generators are used throughout the world.

FERRANTI

OVER 5,000,000 kVA
per annum
of TRANSFORMER CAPACITY

The Ferranti transformer plant at Hollinwood, Lancashire, England, covering an area of over 300,000 sq. ft. has a manufacturing capacity per annum of over 5,000,000 kVA of Large Power Transformers, Distribution Transformers, Voltage Regulators, High Voltage A.C. and D.C. Impulse Testing Plant and Specialised Equipment. Contracts include the supply of transformers for the Garrison Dam and McNary Dam Projects in the U.S.A. and the Alcan Project in Canada.

FERRANTI

NEW YORK
Ferranti Electric Inc., 30 Rockefeller Plaza, N.Y. 20

TORONTO & ST. CATHARINES
Ferranti-Packard Electric Ltd., Ontario, Canada

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FT 176/2

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THE BALL THAT COUNTS!

...and Bituminous, too!

BEHIND BITUMINOUS is unlimited supply and ever increasing technology of utilization. *No other usable power source is backed by both these important characteristics.*

You can base your constant power-fuel needs on bituminous with confidence—B&O Bituminous, of course! ***Ask our man!***

BALTIMORE & OHIO RAILROAD, BALTIMORE 1, MD., PHONE: LEXINGTON 9-0400

BALTIMORE & OHIO RAILROAD
BITUMINOUS COALS FOR EVERY PURPOSE

Daystrom Tests Computer

(*Continued from page* 94)

peratures, pressures, and flows and scans them in rapid sequence to determine whether they are within pre-set operating limits; (2) Sets off alarm if measured and/or computed variables are found to be outside preset upper and lower operating limits; (3) Identifies and locates the cause of the trouble; (4) Provides a record which indicates time and location of the difficulty, also giving deviation from the normal; (5) At regular intervals, it prints the value of each of a multiplicity of variables in the process system; and (6) On demand, any one of the measured and/or computed variables may be typed out in its correct dimensional unit every 12 seconds.

On the basis of experience at Sterlington, says Hess, Louisiana P&L is installing another Daystrom-designed-and-manufactured digital computer control system at its new 230-Mw station which will go into service at Little Gypsy, La, in 1961. This will be the first such fully automatic utility installation in the country. The equipment will continuously monitor 1,226 check points and, based on the information derived therefrom, automatically start, operate, and shut down the generating station.

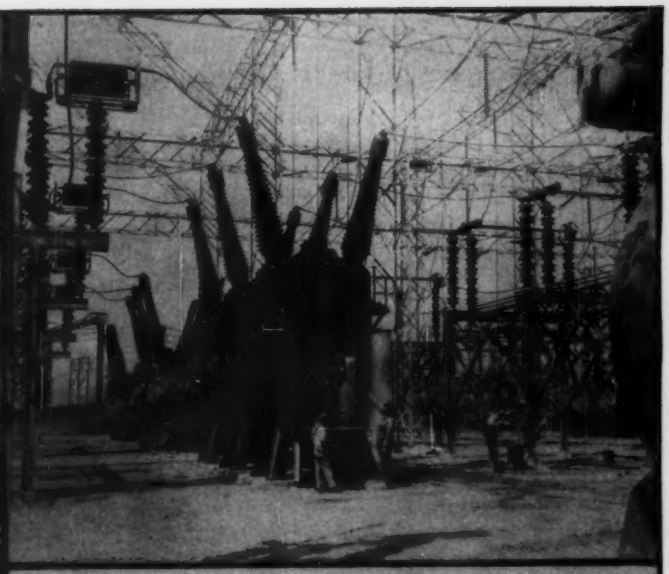
AIEE Publishes Standards On Power System Dences

The following standards publications have been made available by the American Institute of Electrical Engineers: "Test Procedure for Magnetic Amplifiers," No. 433; and "Recommended Guide for Measurement of Rotary Speed," No. 533, both free of charge.

"Practices and Requirements for Pool-Cathode Mercury-Arc Power Converters," No. C34.1, is $1.40; "Schedules of Preferred Ratings for Power Circuit Breakers," No. 37.6, 50¢; "Requirements for Automatic Circuit Reclosers and Automatic Line Sectionalizers for Alternating-Current Systems," No. C37.22, $1.35; "Requirements for Electrical

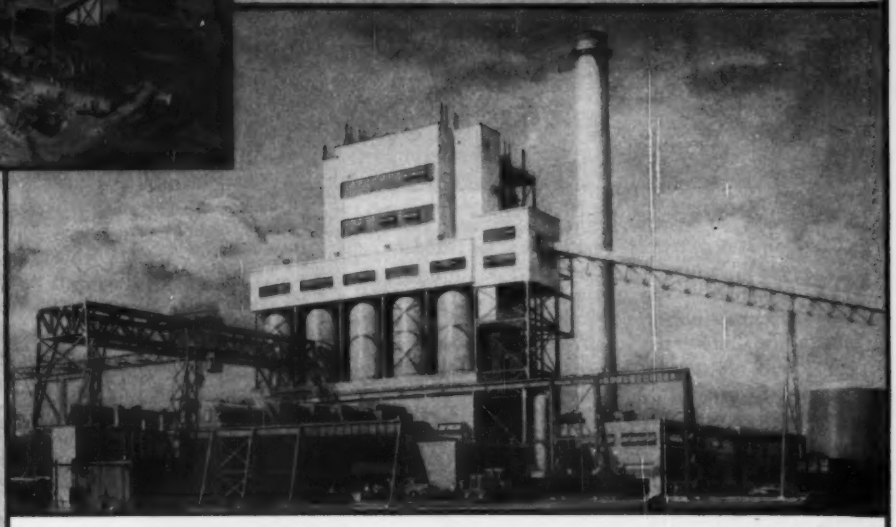
(*Continued on page* 98)

RAO PROGRESS



ONE OF THE LARGEST 345,000 VOLTS HIGH TENSION DISTRIBUTION SWITCHYARDS.

THE PORT JEFFERSON POWER PLANT OF THE LONG ISLAND LIGHTING COMPANY



THE E. F. BARRETT POWER PLANT OF THE LONG ISLAND LIGHTING COMPANY

JOSEPH W. RAO
President & Founder

With commercial demands steadily and rapidly increasing, we take great pride in the fact that the RAO ORGANIZATION is constantly contributing to the efforts and growth of our great country.

In power plants, such as these, *we supply the High Voltage* Power Distribution Systems that feed the arteries of our Nation's Industries, and help make possible the production of many of the essentials we enjoy in our American Way of Life.

Joseph W. Rao

RAO ELECTRICAL EQUIPMENT CO., INC.

Electrical Contractors and Engineers

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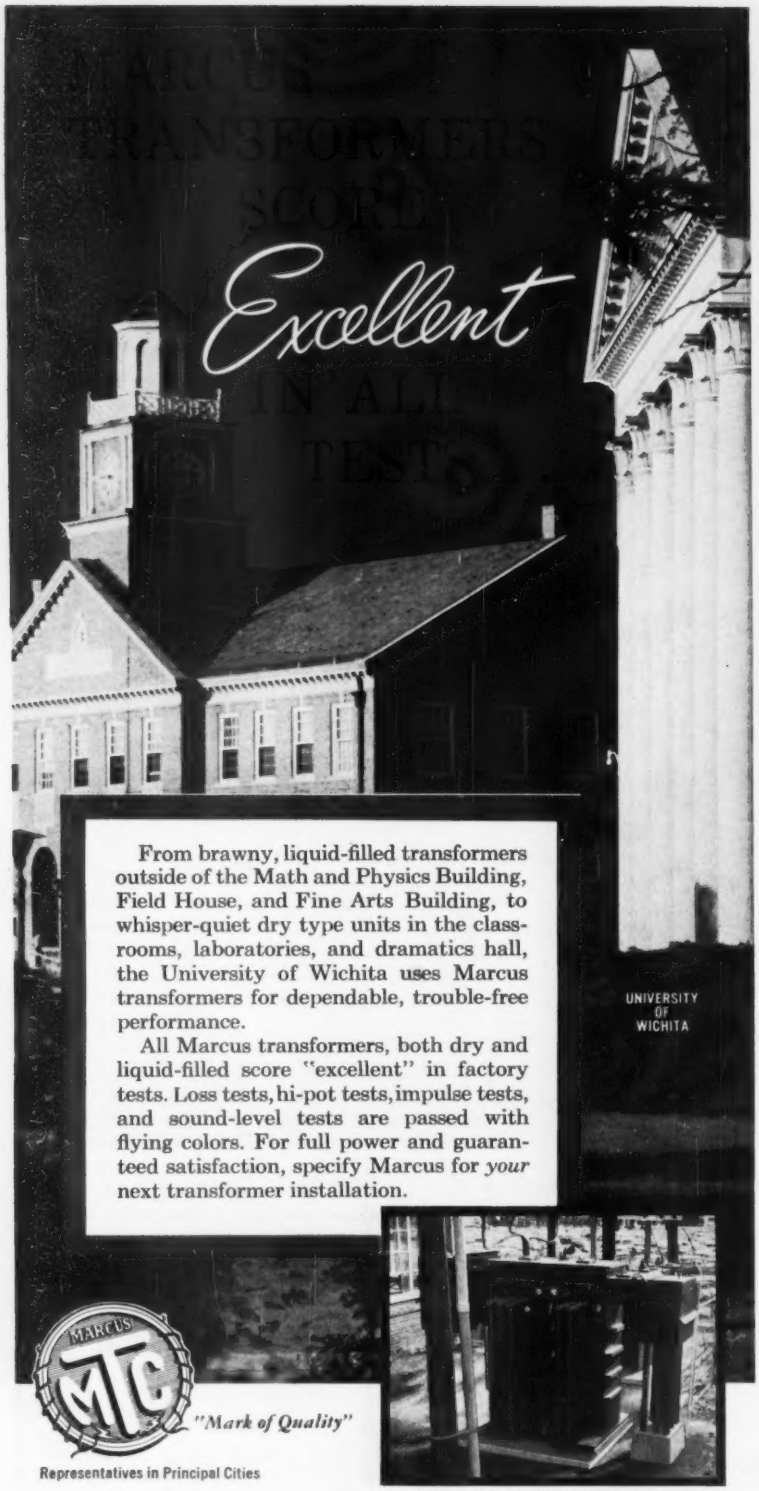
MUrray Hill 5-9500

RAO E.E.C.O. INC.

Savannah, Ga. ADams 2-7151
Charleston, S. C. Sherwood 4-8185

An Organization with Every Conceivable Type of Electrical Installation to Its Credit Operations in the United States and Canada



From brawny, liquid-filled transformers outside of the Math and Physics Building, Field House, and Fine Arts Building, to whisper-quiet dry type units in the classrooms, laboratories, and dramatics hall, the University of Wichita uses Marcus transformers for dependable, trouble-free performance.

All Marcus transformers, both dry and liquid-filled score "excellent" in factory tests. Loss tests, hi-pot tests, impulse tests, and sound-level tests are passed with flying colors. For full power and guaranteed satisfaction, specify Marcus for *your* next transformer installation.

1500 KVA OIL FILLED TRANSFORMER

MARCUS MTC "Mark of Quality"

Representatives in Principal Cities

MARCUS TRANSFORMER CO., Inc.

RAHWAY, NEW JERSEY

A COMPLETE LINE OF DRY TYPE AND LIQUID-FILLED TRANSFORMERS THRU 5000 KVA

AIEE Publishes Standards

(*Continued from page* 96)

Indicating Instruments," No. C39.1, $2.50; "Guide for Loading Oil-Immersed Distribution and Power Transformers," No. C57.92, $2.00; "Guide for Loading Dry-Type Distribution and Power Transformers," and Terminology for Relays," No. 83.16, $2.00.

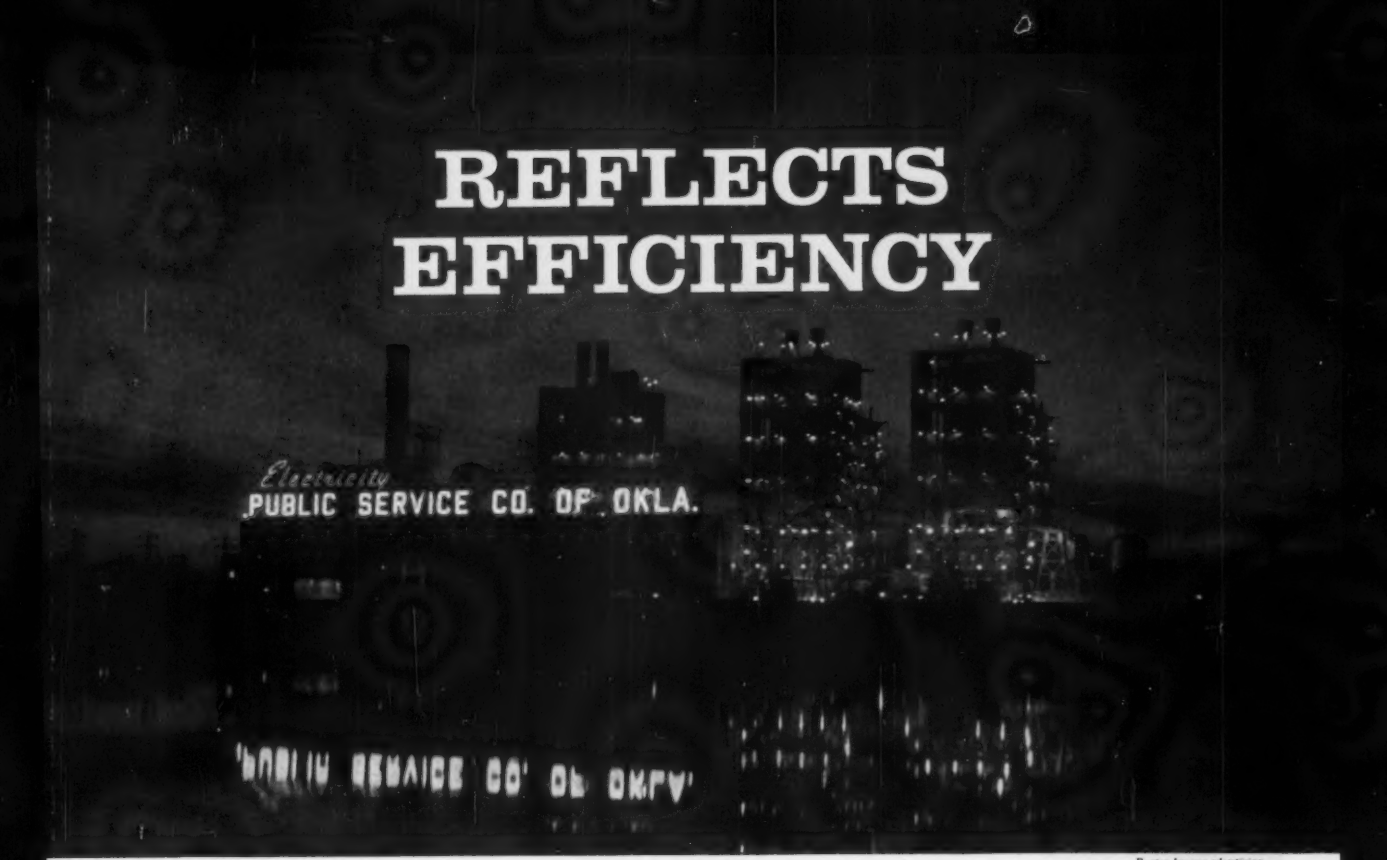
All but C37.22 may be obtained by AIEE members at a 50% discount; No. C37.22 is 70¢ per copy to members.

MANUFACTURERS BRIEFS

Multi-Amp Electronic Corp will supply to Yankee Atomic Electric Co a 5-kva portable testing unit for checking feeder circuit breakers prior to installation at the 134-Mw Rowe, Mass, plant. It is first unit of this type to be used for this application in a nuclear electric generating plant, says Multi-Amp. Breakers to be tested are low-voltage, 25,000-amp interrupting. Unit will be used later in the preventive maintenance program. Input of the model used for testing is 480-v, 60-cycles, single-phase. . . . **Leeds & Northrup's** President I. Melville Stein predicts increased demand in '60 for products made by the instruments and controls industry. He also forecasts a 10% increase in the sales of his company, barring renewal of the steel strike. On the basis of the figures of the first 11 months of '59, he expects L&N's '59 orders to exceed by 25% the '58 total. American manufacturers, in the face of foreign competition, must obtain higher productivity and lower costs, says Stein. Instrument users are cutting present maintenance costs, as well as preparing for the future by sending engineers and technicians to cost-free training schools maintained by instrument manufacturers. At the same time, he added, the instrument industry, in advocating modernization of facilities and addition of research centers, is keeping pace itself . . . **The Fluor Corp, Ltd,** reported an estimated consolidated net loss of $752,000

(*Continued on page* 100)

REFLECTS EFFICIENCY



Burton browne advertising

because PANALARM REDUCES LOGGING TIME TO SECONDS...CURTAILS COSTLY OUTAGES

Public Service Co. of Oklahoma reports greater continuity of service and fewer costly outages from using PANALARM Annunciators in its new Tulsa station

PANALARM "flashing-ringback sequence" Recording Annunciator System converts raw data into usable information in seconds—a tremendous improvement over slow, old fashioned manual logging. Costly outages are fewer because of the speed and reliability with which off-normal conditions are registered.

The Recording Annunciator System sounds an alarm when trouble occurs. Simultaneously, it prints an accurate alpha-numeric digital record of the date and time of trouble and identifies the equipment that failed and/or returned to normal, eliminating possibility of operator error.

Another big advantage is that it continues receiving and recording information during emergencies, relieving the operator of this burden. The operator then concentrates his entire attention on ending the emergency. Later, a precise, sequential record is available for both operators and engineers to study as a basis for preventive maintenance and action.

For an optimum competitively priced Recording Annunciator System for your plant, talk to Panellit engineers.
Sales and engineering offices in all principal cities.

PANALARM ANNUNCIATORS record critical information on 7 turbine generators related to differential shutdown, overvoltage, ground detection, motor control, loss of field, pressures, temperatures, and shutdown or bus tie transfer operations.

For complete technical details on the Recording Annunciator, write for Bulletin 102A today.

PANALARM DIVISION OF PANELLIT, INC. PANELLIT

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Annunciators • Control Panels • Data Systems • Contract Maintenance and Installation

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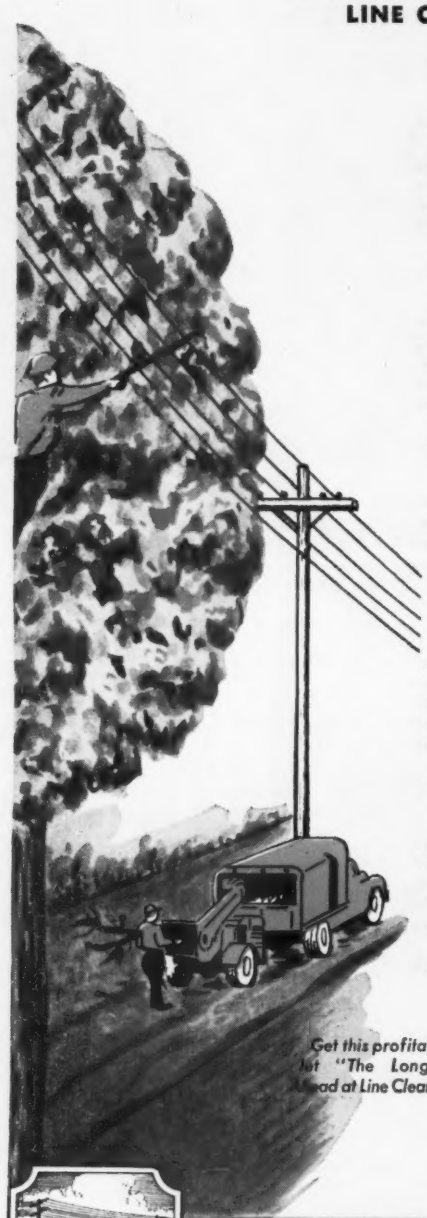
CLEAR THE WAY TO LOWER LINE COSTS

ONLY COMPLETE COAST-TO-COAST LINE CLEARANCE SERVICE



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Mechanized Lifts, Chippers, modern tree trucks, and specialized tools combined into proper operating units reduce manpower and costs in some cases as much as 40% to 50%.

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Nationwide safety program reduces accidents to minimum . . . assures line clearance with no delays and lowest possible cost.

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A program unmatched in the line clearance field both in scope and high limits of protection. Coverage can be provided to meet your needs at a low cost.

GOOD PUBLIC RELATIONS
FOR SATISFIED CUSTOMERS

Asplundh men understand the value of courtesy and good workmanship in keeping your customers satisfied. Their public relations training assures good will for your Company.

ASPLUNDH TREE EXPERT COMPANY
Jenkintown, Pa. and Principal Cities

Get this profitable booklet "The Long Look Ahead at Line Clearance."

ASPLUNDH

More Manufacturers Briefs

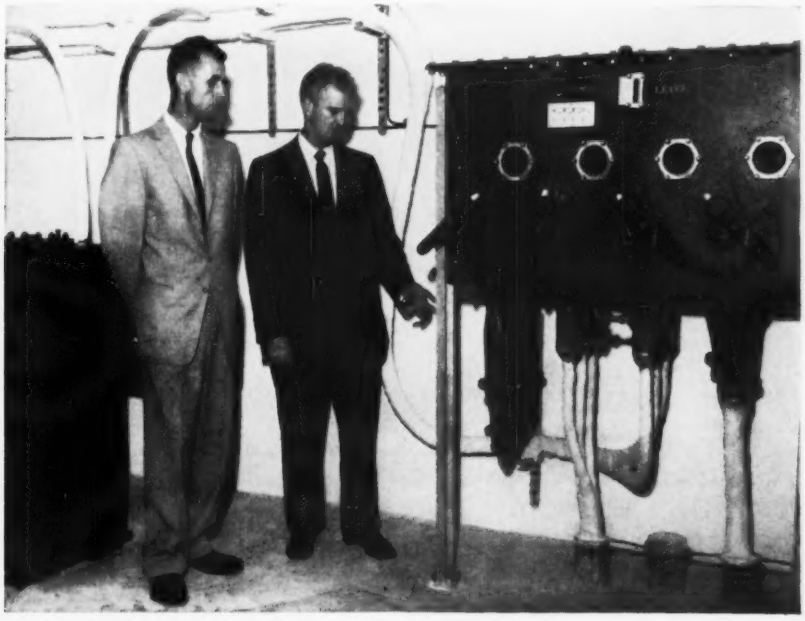
(*Continued from page* 98)

for the fiscal year ended October 31, after non-recurring write-offs amounting to $1.3 million. This compares with net earnings of $1.9 million for the previous year. Consolidated net sales were about $110 million, compared with $120.5 million in '58. New orders received during the 12 months totaled $70 million, compared to $115 million for '58. Backlog of uncompleted work at year's end was $56 million, against $86 million a year before . . . **General Electric** spokesmen recently quoted savings possible through use of fully automated steam generating stations used in conjunction with transistorized digital computers compatible with existing sensing devices. Automation could realize capitalized savings on a 500-Mw steam station, for example, of about $1¼ million to $2¾ million. Cost of installing automation equipment for this size plant runs about $1 million more than for conventional control equipment, which could be paid off through operational economies. Chief economy: improved reliability, if increased as little as ¼ of 1% would save $750,000 for a 500-Mw station, and if increased ½ of 1%, $1½ million. More precise control of operating coditions would provide a further $750,000 capitalized saving. Fuel economy would realize capitalized savings as high as $500,000; elimination of recording instruments about $50,000. GE says staff could probably be reduced one man per shift, for a capitalized saving of $200,000 . . . **Mears Electric Circuit Breakers,** which makes air and fused circuit breakers, 600 to 6000-amp, will move into a new building at Beaverton, western suburb of Portland, Ore, shortly. The 20,000-sq-ft one-story building will have improved facilities for testing, shipping and storage of thermostats and circuit breakers. The plant offers expansion possibilities for the company, launched in 1957 when it bought out Electric Controls, Inc, and reinforced when it acquired stock interest held by Cemco Electrical Mfg Co, Ltd, of Canada, when Cemco sold out to Federal-Pacific Electric Co.

PORT OF SAN DIEGO UNDERGROUND DISTRIBUTION SYSTEM PLANNED FOR FLEXIBLE, DEPENDABLE SERVICE AND EASE OF EXPANSION

Continuity of power service at the Port of San Diego 10th Ave. Terminal is a "must." An extensive array of material handling equipment will serve the warehouse as well as rail and truck transportation required to load and unload nine ocean-going freighters simultaneously. Adequate provisions have been made to maintain continuous electrical service for the 2600-foot wharf even when the need occurs for expanding its present facilities.

Sound planning included two lines of service to each transformer through the use of twenty-six submersible G&W 3-pole, 15 kv, 400 ampere load break oil switches. Two types were used. The Type RAL is a 3-way unit serving the function of three separate switches—1) a loop-through, 2) an isolating and 3) a double throw switch. The Type RAM is a 4-way unit that permits variable combinations of feeders and loads by tying to the switch bus through individual load break disconnects. Stud bushing compartments on the switches make system expansion possible without interruption of power service. There is a G&W load break oil switch to solve your problem. A G&W representative will be glad to tell you about them or send for the new switch folder for additional information.



J. E. Liebmann, Harbor Engr. (left) and Willis Lipscomb, Design Engr., point out stud bushing compartments on G&W Type RAM switch. These compartments permit connection of additional cables without taking the switch out of service, thus avoiding an outage.

G&W ELECTRIC SPECIALTY COMPANY

3500 West 127th Street, Blue Island, Illinois

Representatives in principal cities • Canadian Mfr.—Powerlite Devices, Ltd., Toronto

G&W

For the MOST DEPENDABLE GUY

YOUR

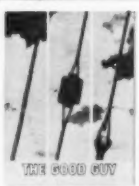
Open Helix Loop

AT THE TOP

AT THE BREAKER

AT THE ANCHOR

Actual Size of 35 GDE ⅜



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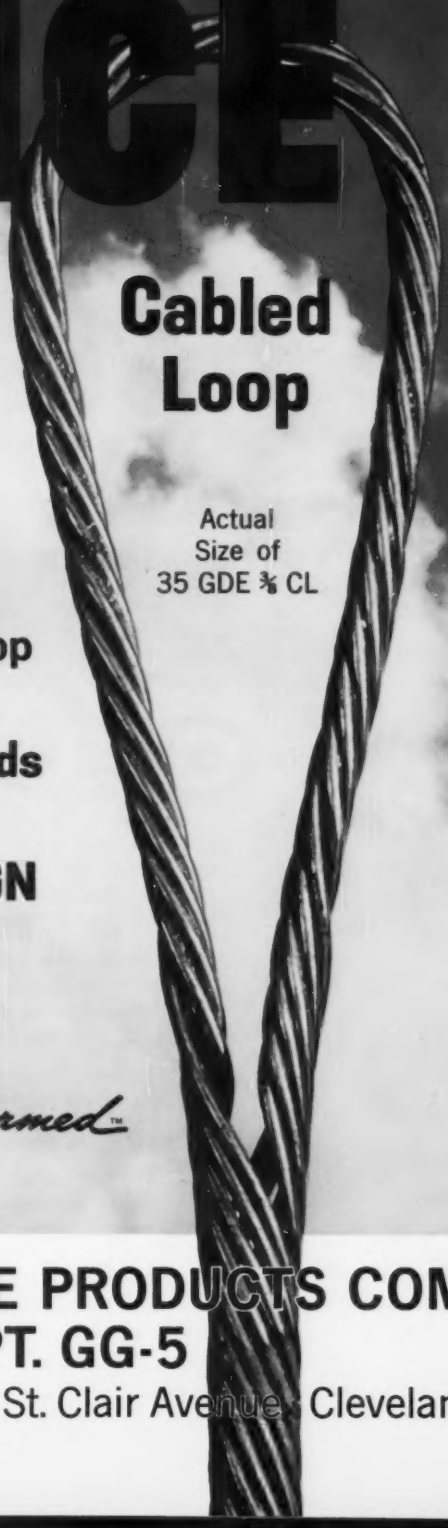
SEND for 32-page Application Procedures book, "THE GOOD GUY," and the 24-page pocket-size companion booklet.

Preformed™ **GUY-GRIP dead-ends**

CHOICE



Cabled Loop

Actual Size of 35 GDE ⅜ CL

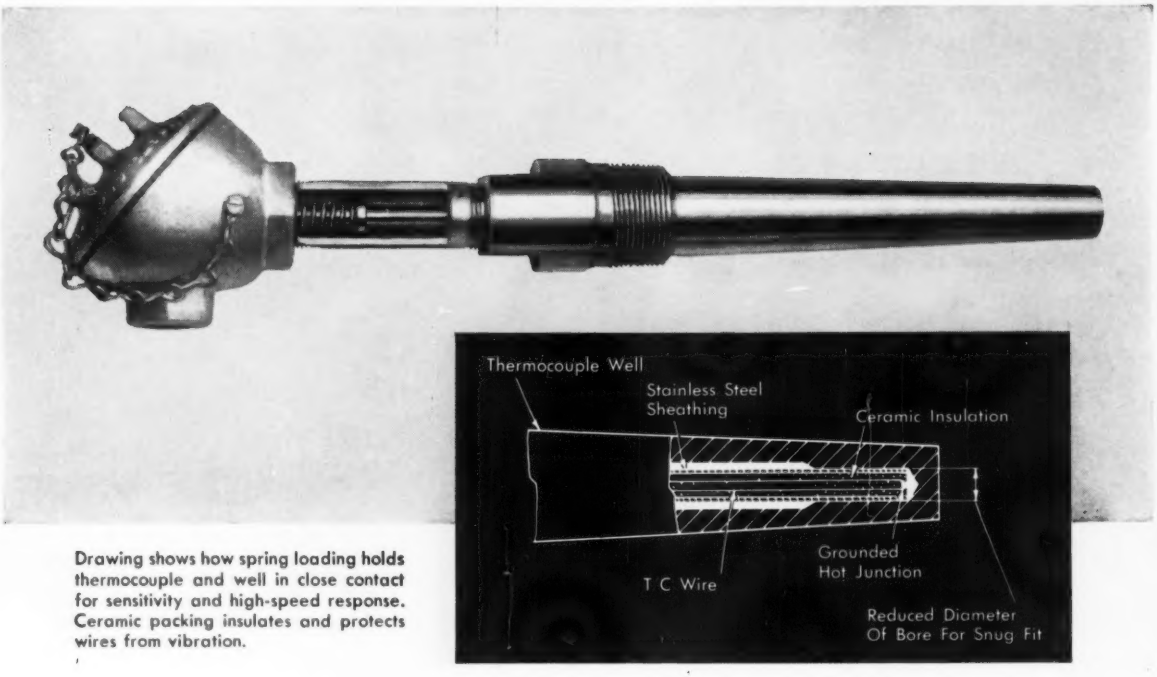
Standardize on one...
or the other...
or a combination of both.
Choose Open Helix Loop or Cabled Loop
GUY-GRIP dead-ends
TO SUIT YOUR SPECIFIC DESIGN REQUIREMENTS

You can look up to Preformed™

TRADEMARK — "GUY-GRIP"

Patented — U. S. Patent Number 2,761,273

PREFORMED LINE PRODUCTS COMPANY
DEPT. GG-5
5349 St. Clair Avenue : Cleveland 3, Ohio



Drawing shows how spring loading holds thermocouple and well in close contact for sensitivity and high-speed response. Ceramic packing insulates and protects wires from vibration.

measure temperatures of high-pressure, high-velocity steam with

New spring-loaded thermocouple

- **High sensitivity**
- **Fast response**
- **Rugged well design**
- **Field-proved**

Design of this rugged, fast-acting thermocouple has been improved to combine high sensitivity with superior mechanical strength.

The thermocouple element is protected from vibration by an inert magnesium oxide packing which holds wire in place inside a stainless steel tube. Two features assure high-speed response to temperature changes: (1) the bore in the well is large enough to permit easy removal of the thermocouple element, and has a smaller diameter near the hot junction to provide a tight fit for highest sensitivity; and (2) spring loading provides positive, metal-to-metal contact between thermocouple and well, for highest rate of heat transfer to the measuring section.

Available in three styles: single-tapered and threaded, and single-tapered for welding in a drilled hole, or double-tapered for welding in a drilled and reamed tapered hole. For working pressures to 5000 psig, temperatures to 1250° F., velocities to 225 fps.

Your nearby Honeywell field engineer can give you complete details. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

- **REFERENCE DATA: Write for Specification 5001-1a**

75th YEAR — PIONEERING THE FUTURE

Honeywell

First in Control

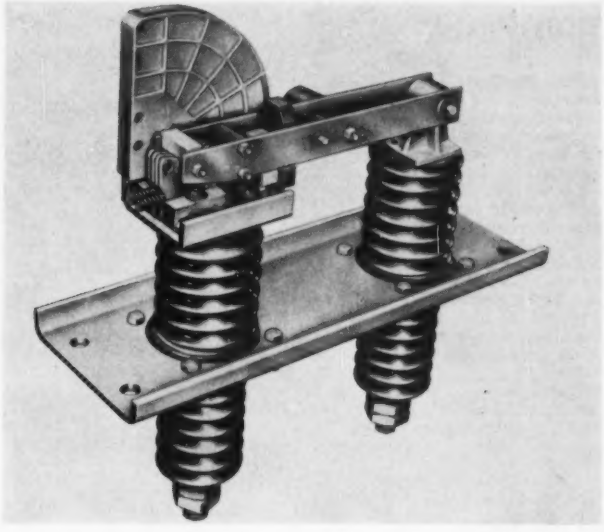
SINCE 1885

(For further information refer to Readers Service on page 112)

Regulators . . .

. . . feature lighter weight and reduced size. Weight of the new line of 5/8% step regulators is up to 40% less and height is reduced as much as 30%, as compared with previous models. A redesigned position indicator has an electrical reset of the drag hands. The position indicator is mounted below the cover for greater safety. Other features of the single-phase JFR regulators include oilsight gauge, unit construction with internal clamping of bushings, terminals adaptable to either aluminum or copper conductors, and horizontal by-pass arrester mounted on the outside of the regulator.

Allis-Chalmers Mfg Co, Milwaukee 1, Wis.



Interrupter Switch . . .

. . . for fault closing requirements up to 40,000 amp features spring-loaded, heavy duty, self-aligning silver-plated stationary main contact fingers. Ratings are listed as 600 amp continuous and 40,000 amp momentary, at 14.5 kv. Other features include silver-tungsten tipped, hard drawn electrolytic copper blades and silver-tungsten tipped, moving and stationary arcing tips.

I-T-E Circuit Breaker Co, Greensburg Div, Greensburg, Pa.

Network Transformer . . .

. . . designed for either vault or subway applications is available in ratings of 300, 500, 750 and 1,000 kva at 5, 15, 25 and 34.5 kv. A universal design permits users to reduce stocks of spare units and simplify specification writing and ordering. Improved corrosion protection for critical welded areas is provided by a better film thickness of paint over the welded seams of the unit's coolers.

Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

(*More New Equipment on page* 106)

C&D AutoCal*
Unitized Power-Pack

Popular mounting arrangement shows how *AutoReg*® Silicon Charger mounts inside switchgear cubicle door with controls projecting through. No manual switching or other adjustment required. PlastiCal® batteries need watering only once a year.

New C&D *AutoCal** *unitized* Power-Pack is specially designed for dependable switchgear tripping and control

Simple *AutoReg*® voltage regulated, current limiting Silicon Charger, paired with long-life PlastiCal® battery, assures high-capacity d-c power in compact package that is virtually *maintenance-free.*

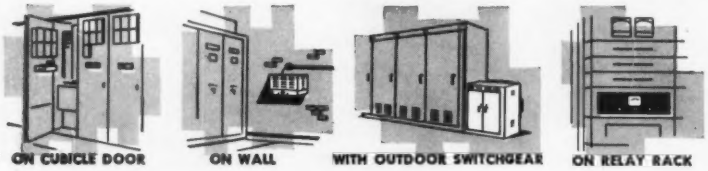
Now, utilities and industrial plants can guarantee an even greater margin of reliability and protection for switchgear and control equipment. The amazing new C&D *AutoCal unitized* Power-Pack always assures full power for tripping and control.

Here, for the first time, is a dependable, high-capacity power package *specially designed for tripping and control.* Virtually maintenance-free . . . with no manual switching or adjustment required . . . *AutoCal* provides many times the life of ordinary battery and charger combinations which may be *adapted* to this critical service.

AutoCal pairs the simple, compact *AutoReg* Silicon Charger with powerful PlastiCal lead-calcium-grid control batteries. A sudden demand for tripping power merely discharges the battery over a short period. While the breaker is tripped, PlastiCal supplies any necessary constant load current as might be required for the operation of pilot lights, holding coils, and similar requirements. Once the circuit is reclosed, *AutoReg* puts energy back into the battery at a high rate until it levels off at full charge.

Here's self-protected charging . . . no charger adjustment or maintenance . . . and 25-year-life PlastiCals only require watering once a year!

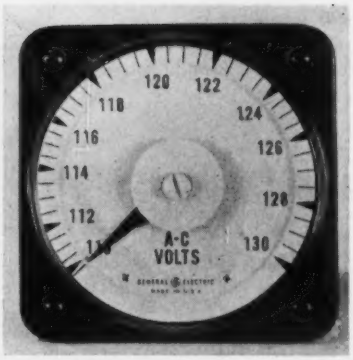
For full details—write for Bulletin AR-102 today!



C&D BATTERIES
of Conshohocken, Pa.... Attica, Ind.
DIV. THE ELECTRIC AUTO-LITE CO.

Manufacturers of Sigma-Clad® Industrial Batteries • PLASTICELL® • and RADIOX® Batteries for Communications, Control, and Auxiliary Power • Producers of *Autoreg*® Silicon Chargers and *AutoCal** • Charger-Battery Combinations.

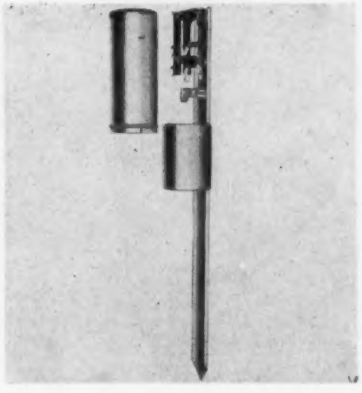
*Trademark



AC Voltmeter . . .

. . . has dial calibrated in ½-v intervals for improved readability and accuracy. Spacing is nearly linear through the scale, and readings accurate to within ± 0.36 v can be obtained. Calibrated from 110 to 130 v, it has a response time of 2 sec.

General Electric Co, Schenectady 5, N. Y.



Fusible Power Pedestals . . .

. . . are designed for use with Transclosures and pad-mounted transformers in underground distribution systems. They facilitate above-ground connection of buried secondary services and mains. Pedestals take eight 2/0 service conductors, two 4/0 secondary mains, and five 2/0 neutral conductors. Terminals accommodate cartridge-type fuses rated through 200 amp. Insulated live components are padlocked.

Line Material Industries, McGraw-Edison Co, Milwaukee 1, Wis.

(*More New Equipment on p* 108)

PERFORMANCE

VICTOR No. 900 10" Suspension Insulators are the universal choice of power men . . . helping maintain continuity of service under the most rugged conditions.

Records of utility companies are best evidence of the performance of VICTOR Suspension insulators. This is the reason why VICTOR is being chosen by more and more power companies for whom the best is none too good.

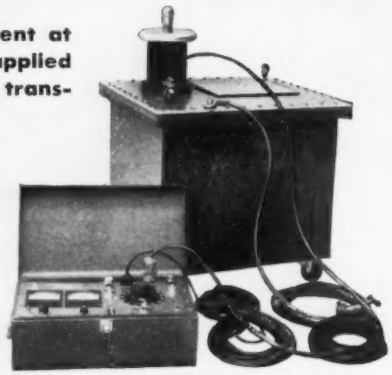
Manufactured under rigid quality controls and tested with the industry's most modern test equipment, VICTOR Suspensions are something particularly special. They're designed right. They're made right. They perform right. Put 'em up today and chances are YOU won't ever replace 'em—they last that long. For catalog, specifications and prices contact VICTOR Insulators Division, I-T-E Circuit Breaker Company, Victor, N.Y.

I-T-E CIRCUIT BREAKER COMPANY

BIDDLE *Instrument News*

BIDDLE DIELECTRIC TEST EQUIPMENT

. . . for measuring direct current at voltages up to 100 kv when applied to the insulation of generators, transformers, bushings, cables, etc.



More and more engineers are leaning to d-c testing with voltages equal to or somewhat greater than equivalent peak alternating voltages. Their experience and increased knowledge and appreciation of the advantages of testing with direct voltage have accelerated the need for test equipment to meet field requirements.

IMPORTANT FEATURES

- Well-designed provisions for utmost safety
- Simple operation and reliable performance
- Excellent output voltage regulation
- Compact, mobile design
- Facilities for voltage and leakage current measurements

IMPORTANT APPLICATIONS

. . . *in development* . . . for testing the d-c dielectric strength of insulating materials and the adequacy of the electric design of insulation in any type of electrical equipment.

. . . *in production* . . . for non-destructively detecting defects in the insulation of electrical equipment due to design, material, and workmanship.

Write for BULLETIN 22-W

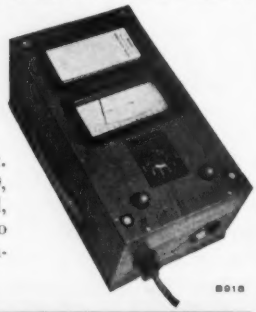
BIDDLE CORONA TEST EQUIPMENT

. . . for use in non-destructive or breakdown dielectric tests on electrical insulating materials, individual insulation structures and insulation of electrical equipment like cables, transformers, switchgear rotating machinery, capacitors, bushing and communication apparatus . . . for measuring corona starting and extinction voltage, apparent corona charge, relative corona current.

Write for BULLETIN 66-W.

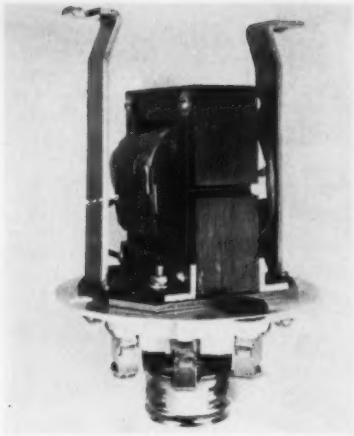
SIX-VOLTAGE MEGGER® INSULATION TESTER

Rectifier-operated from any 115 v, 60 cps Circuit. Single Range, 10,000 megohms at 500, 750, 1000, 1500, 2000, 2500 volts d-c. Completely self-contained, one-man operated Megger Instrument designed to meet the growing needs for multi-voltage insulation tests. **Write for BULLETIN 21-20-W.**



JAMES G. BIDDLE CO.

Electrical Testing Instruments • Speed Measuring Instruments
Laboratory & Scientific Equipment
1316 ARCH STREET, PHILADELPHIA 7, PA.

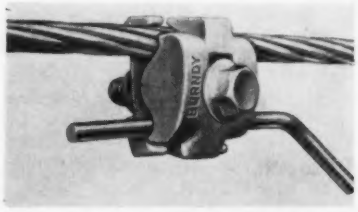


Street Lighting . . .

. . . conversion kit is used to change EEI-NEMA street lighting from incandescent to mercury. Available for 100, 175, 250 and 400 w lamps operating on line voltages of 240 v, the package includes a lamp socket, reflector plate, choke-reactor and anodized mounting bracket.
Sylvania Electric Products, Inc, Ipswich, Mass.

Mobile Radio . . .

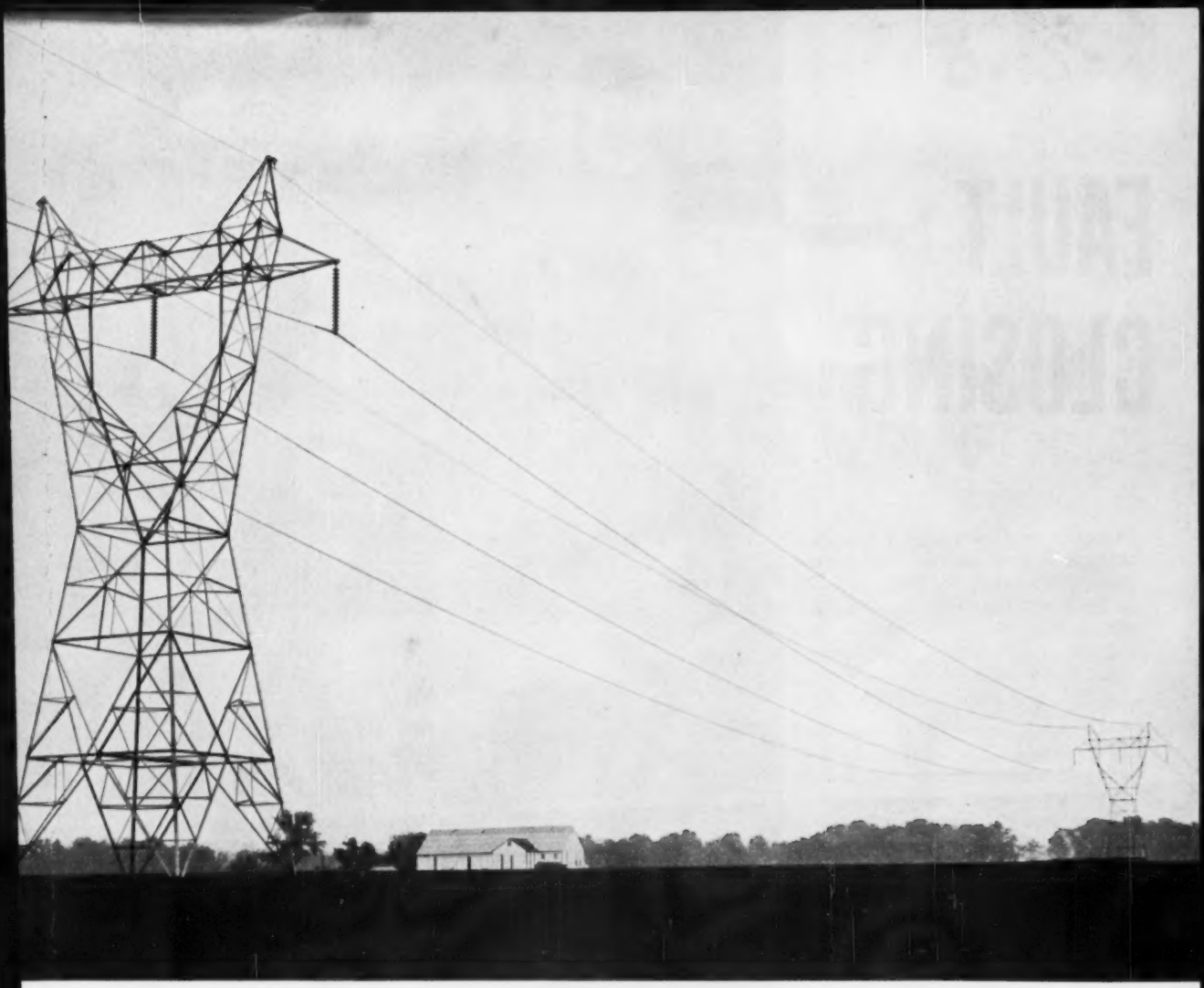
. . . is available in 30 or 60-w transistorized models. Known as the RCA LD-150, the device can operate on any frequency in the 148-174 Mc band. A "heat sink" encircling the equipment case helps reduce internal temperature up to 40%, prolonging component life. **Radio Corp of America, 30 Rockefeller Plaza, New York 20, N. Y.**



Parallel Groove Clamp . . .

. . . has interlocking fingers to simplify connections. An addition to the company's "Tapit" line, the aluminum connector, designated

(*Continued on page* 114)



Ground wires of Bethanized Strand protect 220-kv tap line

This 26-mile tap line, originating at the South Akron (Pa.) substation of Pennsylvania Power & Light Company, will eventually connect with the Brunner Island Steam Electric Station. The 220-kv line has 137 towers, with spans ranging from 581 ft to 1540 ft. Its three power conductors are protected by two overhead ground wires of ½-in. extra-high-strength bethanized "C" coated strand. Siemens-Martin "C," in ⅜-in. diameter, is used for the counterpoise.

Utilities can obtain virtually any degree of protection against corrosion with bethanized strand. In addition to the "C" coating, bethanized strand comes in three other coating weights—A, B, and D. Each coating is 99.9 per cent pure zinc, applied to the strand wires by a special electrolytic process. The coatings are ductile, and uniform in thickness.

The "D" coating, furnished in common, Siemens-Martin, and high-strength grades, contains four times the weight of the "A" coating. Yet the "A" coating is adequate for any installation where atmospheric conditions are good. The "B" coating is twice the weight of "A"; the "C" coating is three times the weight of "A."

If you would like full information on bethanized strand, drop a line to the nearest Bethlehem sales office.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

FAULT CLOSING

S&C metalclad switchgear meets all requirements of new National Electric Code for fault closing, short-circuit interruption. Performance proved by high power testing at KEMA laboratories.

S&C metalclad switchgear can close on any fault up to 60,000 amps

No danger to equipment—no danger to operator even if he closes load interrupter switch on the heaviest faults. S&C's new line of metalclad switchgear is rated as high as 44,500 amps fault closing, 500 mva short-circuit interrupting at 14.4 kv. And at 4.16 kv, the corresponding ratings are 60,000 amps, 250 mva!

Here's how it works: 1) Fault never flows through interrupting unit when switch is closed . . . it flows through separate arcing contacts; 2) Arcing is minimized and magnetic forces are overcome by quick-make, quick-break toggle action no matter how slowly operator closes handle.

Short-circuit interrupting duty (up to 500 mva) is handled by a new boric acid power fuse, the Type SM, which features multiple bore construction to handle low, medium, and high faults.

The simplicity of the S&C design—power fuses for short-circuit interruption and load interrupters for manual or automatic load switching—enables you to save as much as 50 percent on your switchgear investment. Why not consider S&C Metalclad Switchgear for your high voltage power systems? In industrial plants and commercial and institutional buildings there are rarely any transient faults, so there is no real need for the automatic reclosing ability of the more expensive circuit breaker type of switchgear.

For more information please consult the telephone directory for your nearest S&C sales office.

S & C ELECTRIC COMPANY

4421 Ravenswood Avenue • Chicago 40, Illinois

Specialists in High Voltage Circuit Interruption since 1910

S&C

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JANUARY 25, 1960

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They're Safe, Clean to Climb and Deliver Many Added Years of Trouble-free Service

LIFE-SPAN Western Red Cedar Poles are clean and protected from top-to-butt. They are the result of years of continuous research and are **completely** immune to decay. To serve the utility industry better, Page & Hill maintains three mechanized yards with modern handling equipment. The LIFE-SPAN treatment applied to P&H poles complies with all approved E.E.I. or A.W.P.A. non-pressure specifications.

When you buy — specify LIFE-SPAN Western Red Cedar Poles! They're your assurance of longer pole-line service at far less per annum cost.

PAGE & HILL, Inc.
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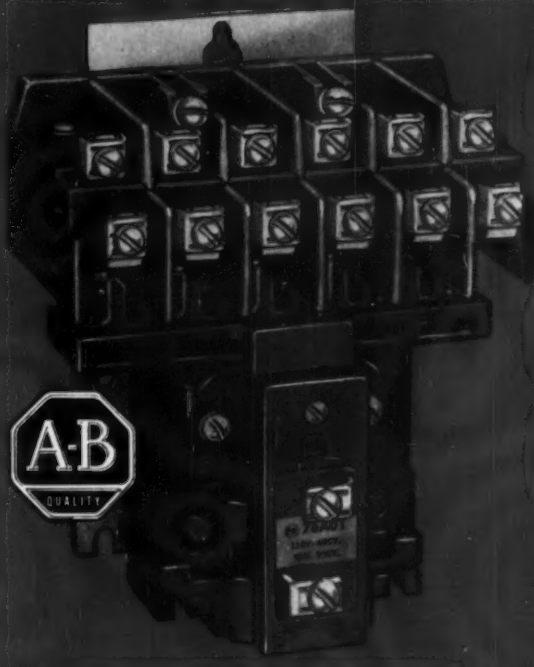
IT'S NEW



Bulletin 700 Type BR Relay with all six of the convertible poles arranged for normally open contact operation.

Allen-Bradley Convertible Contact CONTROL RELAY

BULLETIN 700

TYPE BR

Changeover made in seconds!

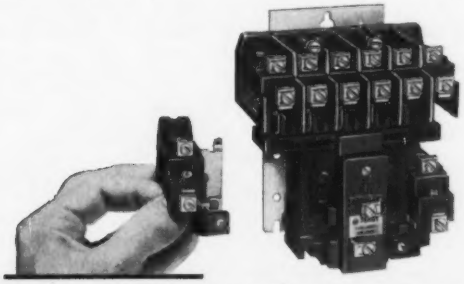
The contacts of the new Type BR relay can be arranged for either normally open or normally closed operation—and any changeover in the field can be made in seconds. A screwdriver is all that's needed.

This new A-B Bulletin 700 Type BR relay is ideal for use on automatic machines where control functions are frequently altered to meet production changes.

Quick convertibility of the contacts enables easy "on-the-spot" changes—from "normally open" to "normally closed"—or vice versa.

These new Bulletin 700 Type BR relays have been exhaustively tested to make sure that they will provide the many millions of trouble free operations for which all A-B controls are famous. In fact, the Bulletin 700 Type BR relays will establish new standards for long relay life and "reliability" of contact operation. Of course, they have double break, silver contacts that never need attention; also, the cast-plastic coil is impervious to the most severe atmospheric conditions.

Please write for full details, today!

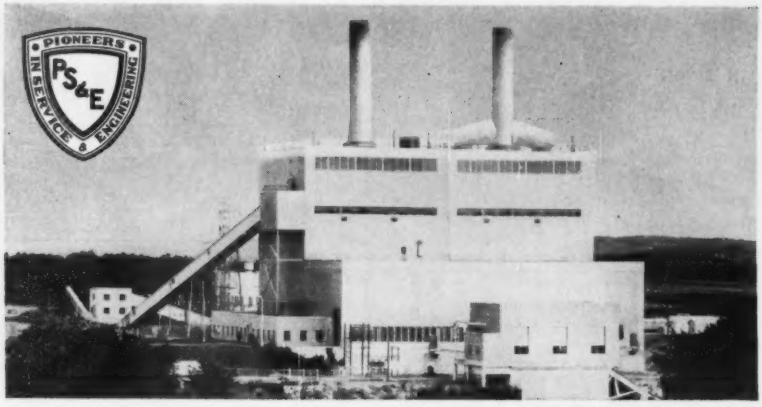


Two extra convertible poles can be easily added—in the field

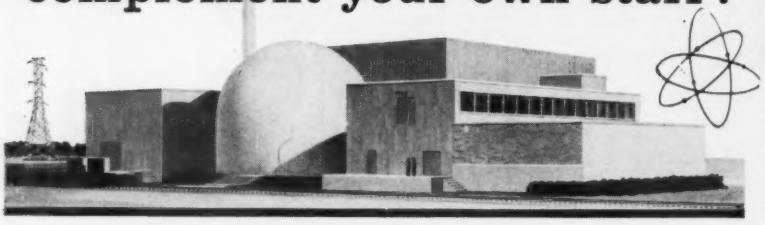
An auxiliary convertible contact pole—having full switching capacity—can be easily added to the left and right sides of the Type BR relays. These auxiliary poles are front-mounted and can be added without disturbing the wiring of the relay—and without removing the relay. All relays are designed to also accept stab connectors, and—all terminals are accessible from the front.

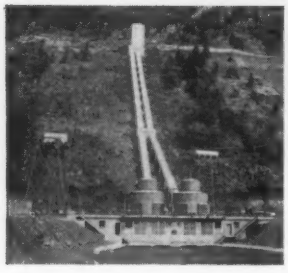
Allen-Bradley Co., 1327 S. First St., Milwaukee 4, Wis. In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

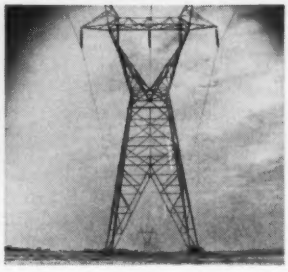
ALLEN-BRADLEY QUALITY MOTOR CONTROL



Which Pioneer service do you need to complement your own staff?







DESIGN AND CONSULTING ENGINEERING SERVICES

Pioneer specializes in designing power plants and offers design service for fossil fuel, hydro and atomic plants. It will also assist in forecasting load growth, in site selection, in purchasing and expediting of equipment and construction management. Pioneer's other services include substation, transmission and distribution studies and design.

SERVICES IN REGULATORY MATTERS

Pioneer offers its services in all phases of Federal, State and local utility regulation, including natural gas and electric rate matters, certificate proceedings, licensed project accounting requirements, depreciation studies for rate case and income tax purposes, cost allocations and special studies.

CORPORATE SERVICES

Pioneer offers its services as business and management consultants; stock transfer and dividend disbursing agents; financial, accounting and tax consultants.

Write for Booklet "PIONEERING NEW HORIZONS IN POWER"

Serving Electric Utilities and Industrial Power Users Since 1902

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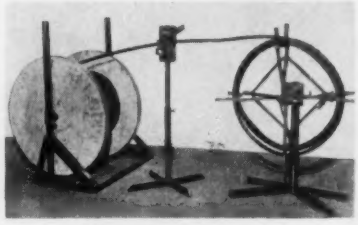
231 SOUTH LA SALLE STREET • CHICAGO 4, ILLINOIS

Parallel Groove Clamp . . .

(*Continued from page* 108)

UCG, accommodates copper, aluminum and ACSR from No. 8 through 1/0. Interlocking fingers on the connector body halves prevent rotation and mismatching. Gripping edges on the hexhead bolt and square surfaces on the connector body facilitate two-wrench installation, while the non-turning square shank simplifies single-wrench installation. **Burndy Corp, Norwalk, Conn.**



Cable Measuring . . .

. . . system consists of reelift, meter, mounting stand and collapsible take-up reel. The meter handles up to 2-in. dia cable and has a wire-guide adapter for measuring small wire. A direct-drive Veeder-Root counter is calibrated in feet and inches. Proper spring-loaded tension is maintained to prevent cable slippage during measurement.
Hykon Mfg Co, 163 E State St, Alliance, Ohio.

Battery Charger . . .

. . . employs silicon rectifiers with a transistor-magnetic amplifier control circuit. The Model 48 TFR (Transistor Float Rectifier) provides line-load regulation of ± ½% from no load to 125% load. Models are also available with outputs from 1.5 to 48 v, single or 3-phase.
Warren Mfg Co, Inc, Littleton, Mass.

Portable Test Set . . .

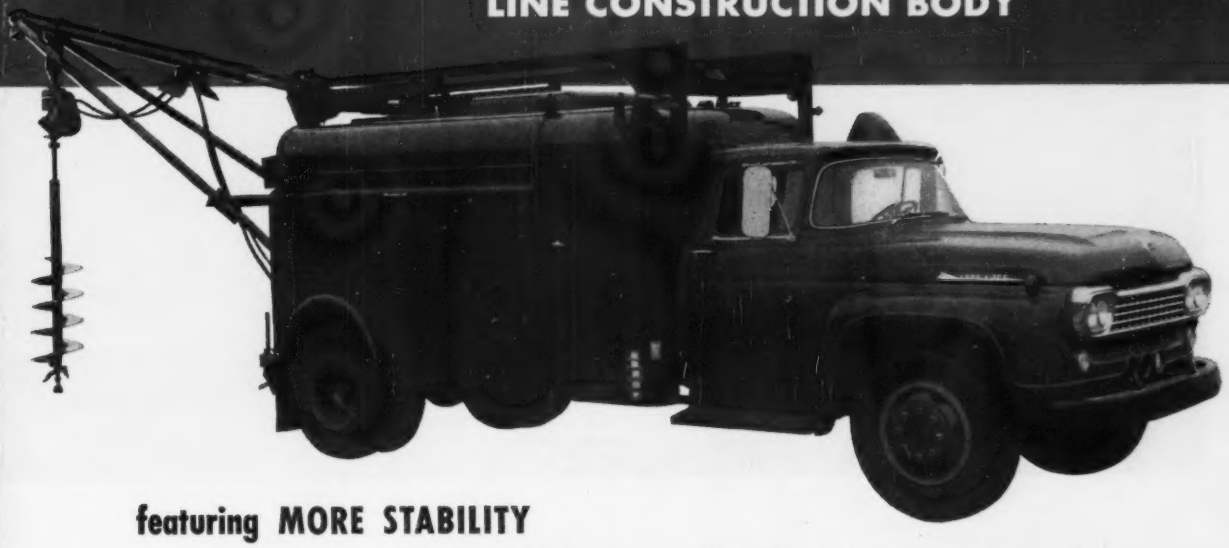
. . . tests distribution transformers up to 250 kva after rebuild, upon acceptance, and for periodic quality

(*Continued on page* 118)

Announcing... NEW

YORK-HOOVER "Bobcat"

LINE CONSTRUCTION BODY



featuring MORE STABILITY

where HEAVY LOADS are handled by THE DERRICK

6 COST-SAVING FEATURES

GALVANNEAL STEEL CONSTRUCTION
superior corrosion resistance

HEAVY DUTY BASE
provides maximum strength and rigidity

SIDE BOXES
arranged for quick access to tools and materials

DOORS
rigid, sag-free, low maintenance

SUPERSTRUCTURE ASSEMBLY
low, compact, easy loading

DERRICK AND DIGGER EQUIPMENT
wide variety, tailored to your needs

GET ALL THE FACTS ABOUT THE "BOBCAT"

CLIP AND MAIL TODAY!

Dept. E, York-Hoover Corporation
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Gentlemen,

Please send us a copy of Bulletin No. 948 covering your new "Bobcat" Line Construction Body.

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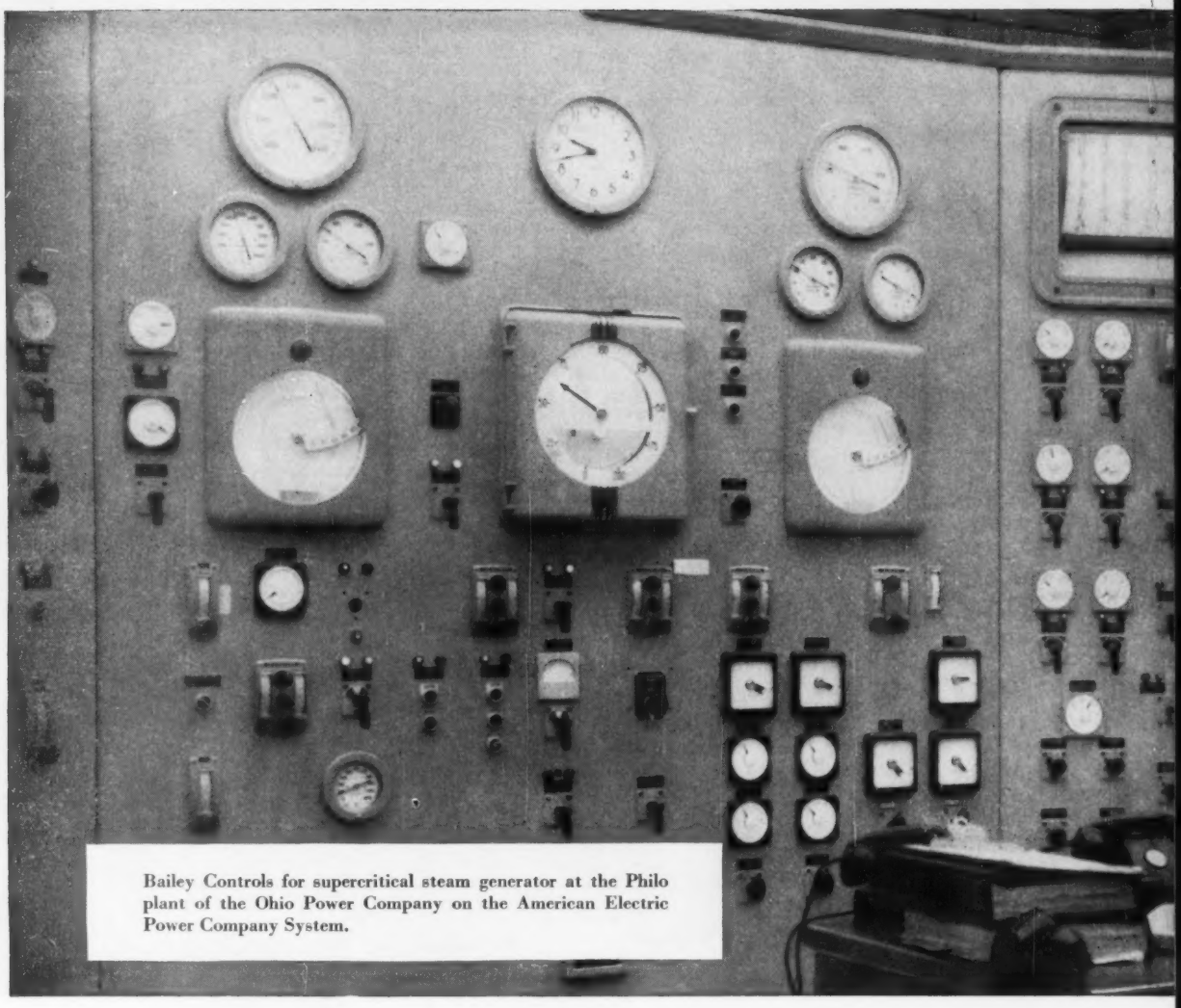
Creative Engineering for the Public Utility Industry Since 1892

YORK-HOOVER CORPORATION, YORK, PA.



Bailey Controls for supercritical steam generator at the Philo plant of the Ohio Power Company on the American Electric Power Company System.

Bailey pioneers the control of...

This is the control center for the first commercial supercritical pressure, steam-electric unit in America. It went into operation March 20, 1957. Tests made during the first year of operation indicate that this new high pressure unit, with Bailey Controls, is establishing new efficiency records in the conversion of coal to electricity.

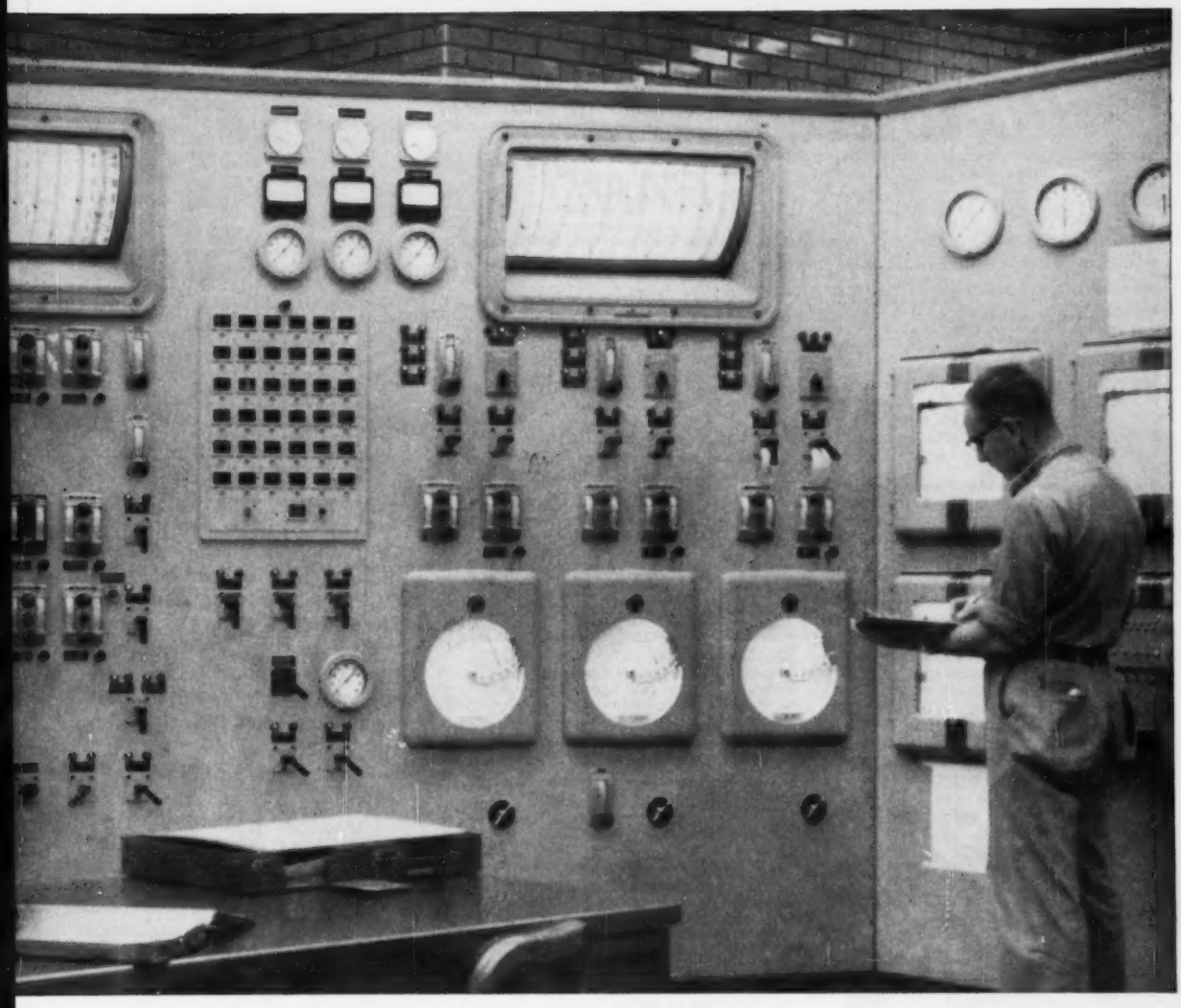
How it works

"Once-through" steam generating units must have radically different control systems from those used on drum-type boilers. At Philo, for instance, the Bailey Control for the 4500 psi, 1150F unit, maintains the desired rate of steam generation by means of a feed water flow controller which regulates feed-pump speed.

In normal operation this controller is set for a constant rate, and boiler outlet pressure is held to the desired value by automatic regulation of the turbine control valves.

An alternative operating method uses the turbine speed governor to regulate turbine control valves and varies feed water flow to maintain boiler outlet pressure.

With either method firing rate is varied to maintain final steam temperature. The Bailey System does this by regulating coal and air in parallel, primarily from changes in feed water flow with secondary adjustments, when necessary, from steam temperature.



SUPERCRITICAL STEAM PLANTS

Optimum combustion conditions are maintained by Bailey Oxygen-Combustibles Recorder-Controllers which continuously sample exit gases from each cyclone and automatically adjust coal feeder speeds.

Seasoned Engineering Experience

For greater fuel savings, less outage and safer working conditions, you owe it to yourself to investigate Bailey Controls. And, for your convenience (and to save time and travel expense) there's a Bailey District Office or Resident Engineer in or close to your industrial community.

Arrange to visit a nearby Bailey installation. We stand on our record. A135-2

Instruments and controls for power and process

BAILEY METER COMPANY

1060 IVANHOE ROAD • CLEVELAND 10, OHIO

In Canada—Bailey Meter Company Limited, Montreal

LET'S TALK ABOUT STRAND...

Aluminized STRAND

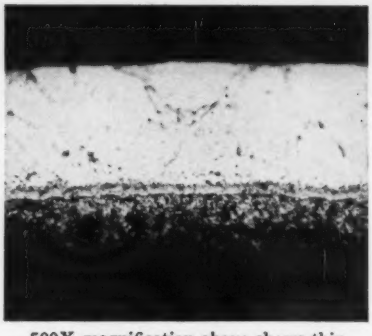
ACCO *Aluminized* steel strand is composed of steel wires which have an adherent, ductile aluminum coating applied by the hot dip method. The result—strand with all the strength of steel, and with the corrosion-resistance of aluminum. Also, you get these important advantages:

Aluminum oxide protection—Aluminum, when exposed to the atmosphere, has a film of aluminum oxide formed over it. This film, though thin, is impervious to corrosive atmospheres, provides extra protection in the most severe service.

Electrochemical protection—Should nicks or cuts pierce the aluminum coating, the corrosion-resistance will be retained by an electrochemical "healing" process.

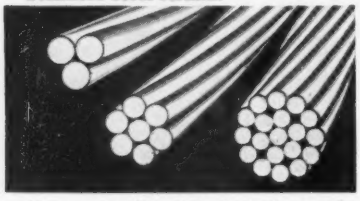
Salt spray tests, conducted according to ASTM procedures, show that with equal thicknesses of coating, *aluminized outlasts galvanized by more than 2 to 1.* Available for guy wire, ground wire and messenger wire applications, Page ACCO Aluminized steel strand is offered in Common, Siemens-Martin, High Strength, Extra High Strength and Utility grades with physical properties conforming to ASTM Spec. A-122-54T and A-363-58.

Page also makes galvanized and stainless steel strand.



500X magnification above shows thin aluminum-iron alloy resulting from diffusion of the two metals, and the outer layer of aluminum in the form of a fine-grain cast structure.

5-year test exposure to industrial atmospheres covered strand with coating of sulfide, oxide and soot. Scrubbing with soap and water showed aluminum coating completely unaffected.



Page ACCO Aluminized steel strand is available with 3, 7 and 19-wire construction.

WRITE FOR DETAILS.

Booklet DH-537 explains manufacture, properties and uses of Page ACCO Aluminized Steel Strand. Write us at Monessen, Pa., for your copy.

PAGE MANUFACTURERS WIRE

ACCO

Page Steel and Wire Division
American Chain & Cable Company, Inc.
Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore. San Francisco, Bridgeport, Conn.

OTHER ACCO ALUMINIZED STEEL WIRES

Aluminized ACSR core wire now available from leading manufacturers of aluminized conductor cable.

Page Chain Link Fence of ACCO Aluminized wire provides economical, longer-lasting protection.

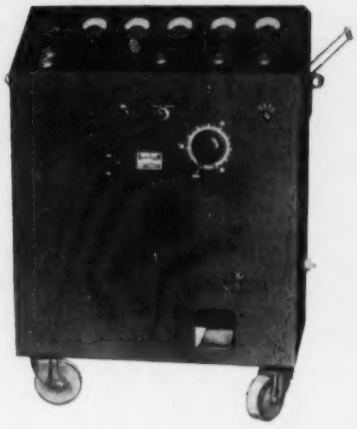
Tie wire, telephone and telegraph wire, lashing wire, barbed wire, and other products are also available in Page ACCO Aluminized wire.

Ask us for details.

PAGE *-the source for answers to wire problems*

Portable Test Set . . .

(*Continued from page* 114)



determination. Unit can be used with transformer primary windings of 2.4 to 15 kv and secondaries of 120/240 v. The set makes six measurements: primary voltage, exciting current, no-load loss, high-voltage output, polarity, and ratio. **Multi-Amp Electronics Corp, 465 Lehigh Ave, Union, N.J.**

More New Products

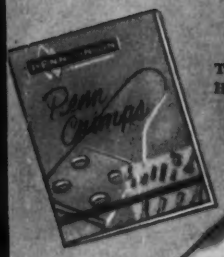
Fiberglass **ladders** have aluminum rungs. The HIMCO extension ladders are equipped with polypropylene rope.—Hopfeld Industrial Mfg Co, 738 A St, San Rafael, Calif.

Portable **indicating pyrometer** measures temperatures between —40F and +200F. Readability of the "Alnor" 2300-B is to the nearest ½ deg F.—Illinois Testing Laboratories, Inc, 420 N La Salle St, Chicago 10, Ill.

Fast, light **air compressor** delivers over 75 cfm at 100 psi. The Porta-Air 75 is designed especially for fast highway towing.—General Supply Co, Kansas City, Mo.

Ultrasonic degreaser quickly removes metal chips, grease and certain insoluble soils from intricate parts. The Model AC-25 Sonogen is housed in a compact stainless steel cabinet.—Branson Ultrasonic Corp, 40 Brown House Rd, Stamford, Conn.

For your convenience—the *complete* line of crimp connectors, No. 22 to 2,000,000 CM. Copper and aluminum lugs, splices, etc., and tools.



TYPE HVJR

TYPE BLU

Crimp

Pioneers in fast economical welding of aluminum bus, Penn-Union is your best source of weld fittings —and *technical help.*

TYPE WTFA

TYPE WLA

Weld

You name it

We have it

Bolt

TYPE RA

TYPE VVL

Many types of bolted lugs, splices, bus fittings, No. 12 to 2,500,000 CM. Copper and aluminum.

TYPE LD

Solder

TYPE SL

TYPE SL

Once the standard connection, still widely used. Single and two-hole lugs, No. 10 to 2,000,000 CM.

PENN-UNION

a good connection

PENN-UNION ELECTRIC CORP., Erie, Pa.

Export Sales—Philips Export Co., 100 East 42nd St. New York 17, N.Y.

Consult this expert on plant location

Build Your Plant Near An Unlimited Fuel Supply

The Squirrel is a sound planner. He builds his nest near Hickories and Oaks so that he will have a plentiful supply of nuts and acorns . . . *"fuel" for the Squirrel!*

Take a tip from the Squirrel. Locate your new plant near a large reservoir of fuel . . . Peabody's two-billion-ton coal reserves. Since shipping charges are a big part of your fuel costs, this close proximity to a dependable coal supply is just good business. It assures your Company an economical source of power for now *and* the years ahead, and protects your capital investment in buildings and equipment.

Let Peabody help you select *your* new plant site—it's an important part of our service . . . and one that can save your Company *millions!*

Learn more about the location of Peabody's 29 modern mines and river dock loading facilities. Write Industrial Development Division, Department EW.

PCC-624

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Offices in: Chicago, Columbus, Des Moines, Detroit, Indianapolis, Kansas City, Louisville, Madison, Wis., Memphis, Minneapolis

HOME SHOW visitors were able to control valance and lamp lighting intensities with rheostats in form of "Better Living" keys

Medallion Home Scores Hit at Show

Many home shows and other large-scale consumer product exhibits have a model home constructed to give the public a chance to view the latest in home building and furnishings. Florida Power & Light Co grabbed such an opportunity at the recent Miami Home Builders' Show to exhibit a full-scale Medallion Home.

The utility decided on using the Medallion Home theme because it served as a focal point of interest for its many sales and trade allies—dealers, distributors, electric contractors, plumbers and, of course, Medallion Home builders. Also, it was a direct way to cash in on national and local Medallion Home, Housepower and Live Better Electrically advertising.

Built with the assistance of electric distributors and builders' supply houses, this three-bedroom house was viewed by a record crowd of more than 256,000 people during the eight-day period.

Due to time limitations, the house was constructed in sections well in advance of the show. Then, as soon as the auditorium was available, the sections were moved in and assembled in what was considered record time.

Completely surrounding the house were 16 pylon moving displays, each sponsored by a prominent South Florida Medallion Home Builder advertising his services. Extending out from these were numerous all-electric kitchen displays provided by electric distributors in the area.

Immediately adjacent to the home was a boxed-in four-counter display used to demonstrate the advantages of electric cooking. Company members, using electric grills, griddles and fry pans on all four counters, cooked food and served samples to visitors.

Fashion Show Held

As an added attraction, Florida Power & Light Co also conducted an "Electric Living" fashion show which helped increase attendance and promoted the sale of appliances.

The Jordan Marsh Co and the Florida Fashion Council presented the show, and power company home service representatives acted as models. A large all-electric kitchen was used as a background for the fashions. Invited guests saw not only the latest on resort styles, but also the latest in electric equipment. The commentary during the show emphasized that electric kitchens provided more leisure for the enjoyment of resort fashions.

Three shows were presented daily to capacity crowds. In order to prevent overcrowding and to assist sales and trade allies, the company had tickets printed that were valid for specific performances only. These were given to participating Medallion Home builders and to electric dealers for distribution to prospective clients and customers.

The company employed television, radio, newspaper and window display advertising to promote the show. This was in addition to the advertising and promotion by the Home Builders Assn. The fashion show tickets were also an excellent means of insuring the attendance of selected prospects.

Participating Medallion Home builders and electric distributors were well pleased with the promotion and the results obtained. One builder received calls from 14 people the day after the show closed. And, as he termed it, "They meant business."

Robert S. Bostwick, FPL sales manager of the Miami area, who designed and produced the company portion of the show, termed it an excellent "team effort" on the part of all sales members.

Save $26 to '60 FORD

That's your first saving—but not your last! Save again with over twice the front tire life! Again with 25.2% greater gas mileage! And it's all certified in tests by independent experts!

We're talking about big money . . . real money . . . *your* money! And there's no question about saving it! Of all the leading makes, Ford Light- and Medium-Duty Trucks are the lowest priced, straight across the board! But initial price savings are just the start!

TRUE TRUCK-TYPE SUSPENSION CUTS TIRE WEAR

Ford Pickups are mustang-tough—built for the roughest going, with the proven truck-type front suspension. However, some 1960 trucks use a soft-type independent suspension which wears out front tires twice as fast. Certified tests by independent research engineers* have proved this. And the difference in wear, over the life of a pickup truck, can amount to $300 in tire savings; even more on a medium-duty truck!

HIGHEST IN GAS MILEAGE!

1960 Ford Pickups are gluttons for *work*—not for gas! That's proved by certified economy tests of Ford's modern six-cylinder engine! It's the same dependable cost-cutter that scored 25.2% more gas mileage than the average of all competitive makes in Economy Showdown U.S.A.!

SIGNED, SEALED CERTIFIED SAVINGS!

Yes, this year, if you buy a Ford instead of a competitive truck, you can be sure to save—Ford's economy is certified! Check the certified records yourself in your Ford Dealer's "Certified Economy Reports"...see and drive the new Ford Trucks . . . check the price tags . . . *and you'll save for sure!*

**Names on request. See your Ford Dealer.*

FORD TRUCKS

$246 on a Truck!

PRICED BELOW ALL OTHER LEADING TRUCK MAKES**

	FORD SAVES YOU
HALF-TON PICKUPS	
F-100 CLASS	$33 TO $181
HALF-TON PANEL	
F-100 CLASS	$40 TO $161
THREE-QUARTER TON PICKUPS	
F-250 CLASS	$32 TO $185
TON-AND-A-HALF STAKES	
F-500 CLASS	$26 TO $246
TWO-TON STAKES	
F-600 CLASS	$33 TO $141

**Based on a comparison of the latest available manufacturers' suggested retail delivered prices, including Federal excise tax, excluding dealer preparation, conditioning and destination charges.

COST LESS

...LESS TO BUY...LESS TO OWN...
BUILT TO LAST LONGER, TOO!

Con Ed Gets $14-Million Interim Rate Increase

Commission grants $10 million of it in industrial and large commercial categories, and orders 'freeze' on conjunctional billing. Commissioner says billing reversal is 'unprecedented'

Consolidated Edison Co of New York, Inc, which recently testified before the New York Public Service Commission that it has a $31-million revenue deficiency, has been granted an interim electric rate increase of $14 million a year. The permanancy and amount of the hike is subject to a final decision in an electric rate case that is presently in progress.

About $4 million of the increase will come from New York City customers, all of whom will pay 1% more. This gives Con Ed a belated chance to recoup a 1% city tax imposed last year. The remaining $10 million of the hike will be paid by customers with a monthly demand over 100 kw and consuming 30-40,000 kwhr and over.

The total increase will provide Con Ed about $6.5 million after taxes.

In a separate decision, the commission reversed its position of last spring and approved the continuation of conjunctional billing for over 5,000 Con Ed customers. The order, which involves owners of buildings who receive electricity separately in each structure but get a single bill for total consumption, came on a 4-to-1 vote by commission members.

Commissioner Mylott Dissents

The dissenting vote was cast by Commissioner Francis T. Mylott, who pointed out that the agency agreed last May to gradually eliminate the practice, and thus provide Con Ed with some $2.8 million of additional revenue a year for five years. The reversal of this decision "is unprecedented so far as I know, as having the effect of bypassing or ignoring in this instance our continuing duty under the provisions of the Public Service Law."

Reason for the reversal, the order stated, was the "economic impact" on customers who would have to rewire and install extra equipment in order to continue receiving single bills for total consumption. The majority opinion agreed with Mylott's finding that "conjunctional billing is unduly discriminatory." The "freeze," however, prohibits new applicants for such billing and also provides that owners now under conjunctional billing will forfeit the privilege if he relinquishes ownership or control of the premises and the new owner will not be accorded combined bills, the majority opinion declared.

The customers billed in this fashion include landlords of about 250,000 apartments in which some 1-million people live.

McMeekin Plant's 9,093-Btu Heat Rate Earns Top Rank

Twenty electric utility steam generating plants make up the industry's "elite" insofar as heat rates are concerned. This is seen in a review of the Federal Power Commission's "Steam-Electric Plant Construction Cost and Annual Production Expenses (11th Annual Supplement 1958)," released recently.

Of the 500 plants listed in the report, 20 had annual heat rates of 9,500 Btu per net kwhr or less. Fifty-six plants aggregating 25,000 Mw had rates of less than 10,000.

The leading station is the 275-Mw Silas McMeekin plant of South Carolina Electric & Gas Co. Located 14 miles northwest of Columbia, S.C., the plant has a heat rate of 9,093 Btu per net kwhr. Other top-ranking stations include:

Clifty Creek, Indiana-Kentucky Electric Corp, 9,130 Btu; Kanawha River, Appalachian Power Co, 9,143; River Rouge, Detroit Edison Co, 9,160; Muskingum River, Ohio Power Co, 9,161; Shawville, Pennsylvania Electric Co, 9,163; Kyger Creek, Ohio Valley Electric Co, 9,166; G. G. Allen, Duke Power Co, 9,178; Tanners Creek, Indiana-Michigan Electric Co, 9,209; Bay Shore, Toledo Edison Co, 9,233.

McMEEKIN: South Carolina E & G's 275-Mw station near Columbia

New Allis-Chalmers 3-phase SFR Distribution Regulator

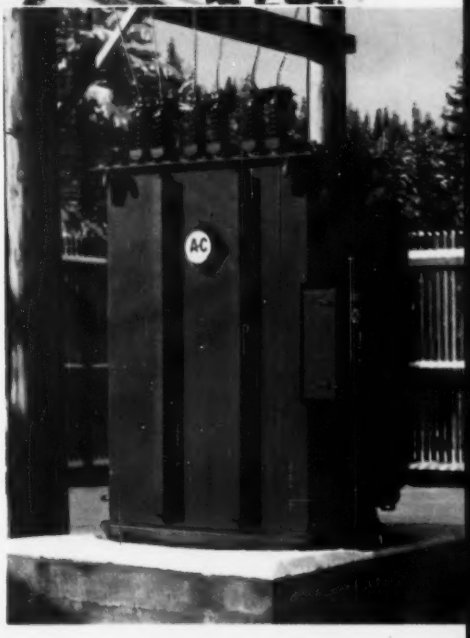
Workmen are busily putting the finishing touches on pastel-shaded dormitories, ski tows, ice rinks and, of course, the electrical system at Squaw Valley.

Here in a narrow, steep-sided valley high in the California Sierras will be held the Winter Olympics a short time from now.

The new, compact, weight-saving three-phase distribution regulator design by Allis-Chalmers was selected as the ideal solution to their voltage regulating problem.

- These units save 33% space; cost 30% less per kva of 3-phase regulation; weigh 20% less; provide 160% *Vari-Amp* rating to 600 ampere maximum.

For help in revaluating your present substation planning, contact your nearby A-C office or Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.



ALLIS-CHALMERS

A-1150-E

powerful reassurance!

In almost every important industrial area, power needs are expected to double again in the next ten years. It is reassuring to utilities, as they plan ahead and build ahead to keep pace with this demand, to know that career coal companies like Island Creek stand ready to deliver the coal needed to generate that power far into decades still uncharted.* Our engineers would welcome an opportunity to talk with yours... about the present... or the future.

Island Creek's vast, proven, available reserves total more today than Island Creek has taken out of the earth in the past 50 years.

You can depend on **ISLAND CREEK**

a career company . . . dedicated to coal

Island Creek Coal Sales Company, Chafin Building, Huntington 18, West Virginia • Chicago • Cincinnati • Cleveland • Detroit • Greensboro • New York • Pittsburgh

Here's the story behind the . . .

Arizona Public Service Revamp

Report on
Organization Development

There was quite a renovation at a utility in the Southwest about a year and one-half ago. The company set out one day with detailed plans in hand. It tore down its whole line-staff management structure. And before the day ended it erected a fresh, new management scheme in its place. The utility—Arizona Public Service Co. Its new structure—the executive, services, operating approach.

The result—Arizona Public Service has no line; it has no staff. Instead, the executive-services-operating plan bunches many former line and staff jobs together into logical groups. Now, there are no line-staff quarrels. There is a company organization that anybody can understand. Fewer levels of management separate the worker from the president. It is simpler to communicate from top to bottom. And the company is more manageable, reports Keith Turley, manager of organization development services.

How did all this get started? Like executives in many companies, some of the key men at APS were worried about organization. Was it effective or not? A committee study gave them their answer. On paper, the company's line-staff setup looked great. But in practice it just wasn't working out. The very limits that line and staff men were asked to operate within seemed to create friction between them. Yet, to succeed just the opposite was needed—a smooth, give-and-take flow of ideas and advice. Staff men, it turned out, were in an uncomfortable position; they had responsibility but no authority. They were often too far from practical problems to view them objectively, and to give sound advice to the line managers. Yet, in practice, staff often wielded authority over line. The line men complained about that, and more.

With the new organization, all that is changed. Now there are clear lines of authority. Everyone has just one boss. There are precise job descriptions. And the bone and muscle and brains of the company seem to fit into a logical

framework. The executive group handles long range planning and shoulders other upper management tasks. The operating group serves the customers. And the services group does anything the other two can't do better for themselves.

A Management Philosophy

Some interesting philosophy lies behind Arizona's Ex-Ser-Op organization. It's fundamental principle is this: Decisions ought to be made by men at the lowest possible level—right at the scene of action where men know the problems, and can weigh the impact of any solution.

The company believes most men want to succeed, not fail. That a man wants to strive to find a still better way to do his job, and to be proud of it when he does. That a man wants to earn respect and recognition for the important things he does.

To have the freedom to succeed, a manager must have the freedom to fail. In other words, he should be self-reliant, APS says. His decisions should be his own and no one elses. A company shouldn't clamp down on its employees with controls that smother their initiative, creativity or self expression.

Committee decisions are out. Meetings are fine for sharing ideas, for stimulating thought—but not for making decisions. In the end, every manager must make his own decisions, and must be accountable for the results they produce.

Persuasion works better than force in handling people—that's another APS maxim. The manager who uses fear to get things done fails to develop the people below him. A man should not have a dictator-boss to tell him what to do; to guide his hand through the motions of a job. Rather, a man should be able to exploit and develop his own talents to the fullest. And he has to do it himself by making decisions that solve the problems he faces in his own department. Give a man a job. Let him do it. Hold him accountable for results. That is the law laid down by the new system.

What goal lies behind this management philosophy? That goal, APS found when it reappraised its overall company objectives, boiled down into eight categories: **(1)** To make a profit; **(2)** To give its customers efficient, dependable service; **(3)** To challenge company managers to do a better job, and to develop new managers to take their place; **(4)** To improve the attitude and ability of its workers; **(5)** To make the entire company more efficient; **(6)** To create new ideas and promote research; **(7)** To build up the company's physical and money resources and **(8)** To fulfill its community responsibilities.

How well APS accomplishes any one of these objectives determines how well it achieves its underlying goal—to make a profit for the owners of the business. APS thinks every one of these objectives is important in that respect; if it misses the mark on any one of them, it will miss the profit mark too.

Every manager must take these eight objectives to heart when he sets the goals for his department in terms of men, dollars, customers, equipment, materials, and time. And with them he can measure his own performance on the job, rechart his course of action and adjust his department's objectives if need be.

Executive, Services, Operating: How It Works

How then, could Public Service organize to meet these objectives? First, APS classified every job in the company into one of seven basic groups: **(1)** Planning, resources and operations; **(2)** Marketing; **(3)** Finance; **(4)** Measurements; **(5)** Management services; **(6)** Customer services; and **(7)** Corporate operations. An

executive officer was picked to head up each group. Result: there were fewer levels of management between the president and the worker. Before, as many as 11 bosses separated an individual from the chief executive. Now, APS feels any more than five levels is inefficient. With more than five levels communications between top and bottom get sluggish, unwieldy.

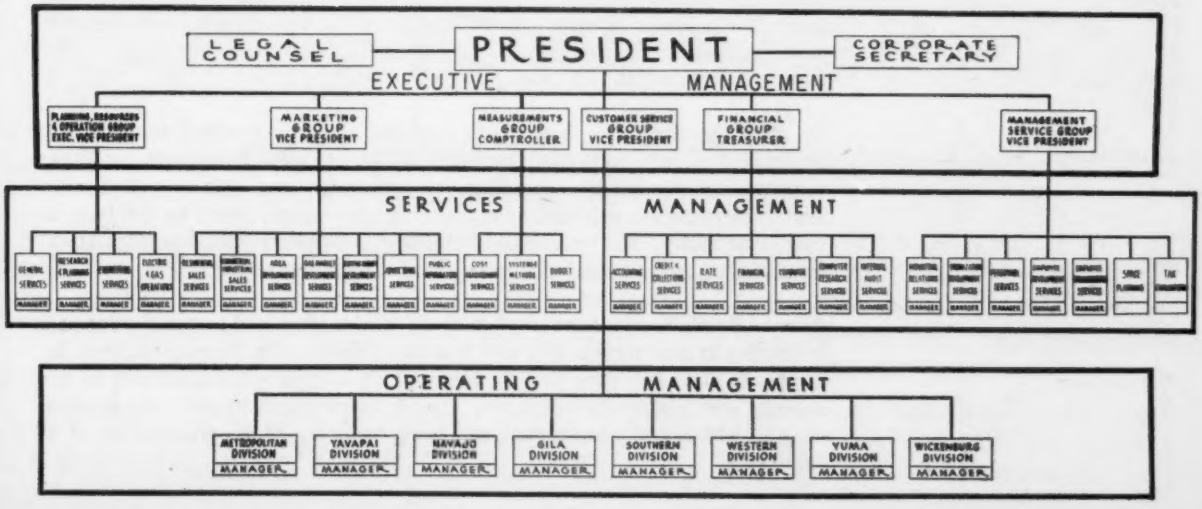
In dissecting its old organization APS even found it had a one-over-one structure—one manager in turn managing another. Now, more managers report to a single boss. With fewer levels, each manager is more self-reliant, has the best chance to develop on the job. And by giving every manager more responsibility, APS feels it has reduced management by second-guessing. That is, making decisions because that's how the boss wants them made, regardless of whether they are a good, or bad, solution to a problem.

You will find three kinds of managers in the new APS setup. There are executive managers, service managers, and operating managers. Every supervisor works somewhere in these three areas. A man's assignment might be line in nature, or staff in nature—or both. That doesn't matter. What does matter is that there are no line or staff jobs per se. The company doesn't even talk about line and staff. So the big woes of line and staff, overlapping authority and friction because of it, are missing.

Here's how the executive managers work. First, they form a team, not a committee, as APS is careful to point out. These men, seven in all, have their responsibilities delegated to them directly by the president. They work together, but their decisions are separate. True, decisions are often based on the recommendations of other executive managers, but in the end a manager's decision is his and his alone. Only he is held accountable for the success, or failure, of his department.

These executive managers work far ahead, on long range problems. They plan, they shape policy, they appraise the performance of their departments. They advise the president and assist him in the overall leadership of the company. Below them stand their own departments, either operating or service.

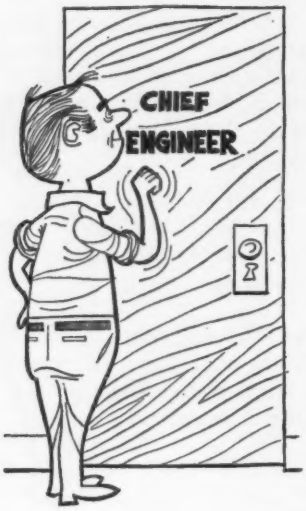
The second group, operating management, runs the generating plants and serves the customers. APS expects these men to do all the work they can perform economically at their own level. It is also their job to ask questions, to seek advice and counsel from other managers and other departments.



The service managers, who make up the third management group, serve and advise all other managers. They appraise performance, teach and consult. They help set objectives, policies and plans. They are the tools of the operating managers, but not their masters. Their job is to give service, not to supervise. They handle design engineering, transmission system construction and maintenance, rate making, finance, labor negotiations, accounting and so on.

To tie these three management areas, and the rest of the company, together APS has adopted a simplified communications policy. Just use common sense and good judgment when you communicate, the policy states. The most direct way, the most practical way, is the best way. The straight-jacket of lines of authority is seldom the best avenue for the flow of ideas and information, APS believes. There is nothing now to stop an employee at the lowest level from going straight to the president's office if that is the best way to communicate. Of course, this policy recognizes that often the usual "chain of command" must be kept informed whenever its advice is required, or when it will be held accountable for results of the communication.

Arizona's comptroller has a new look too. His job goes a lot further now than to simply supply top management with financial reports. Instead, he feeds tools and facts to all managers so they can measure their own performance. To aid him, he has three managers who specialize in budget planning, procedures, and measurements.



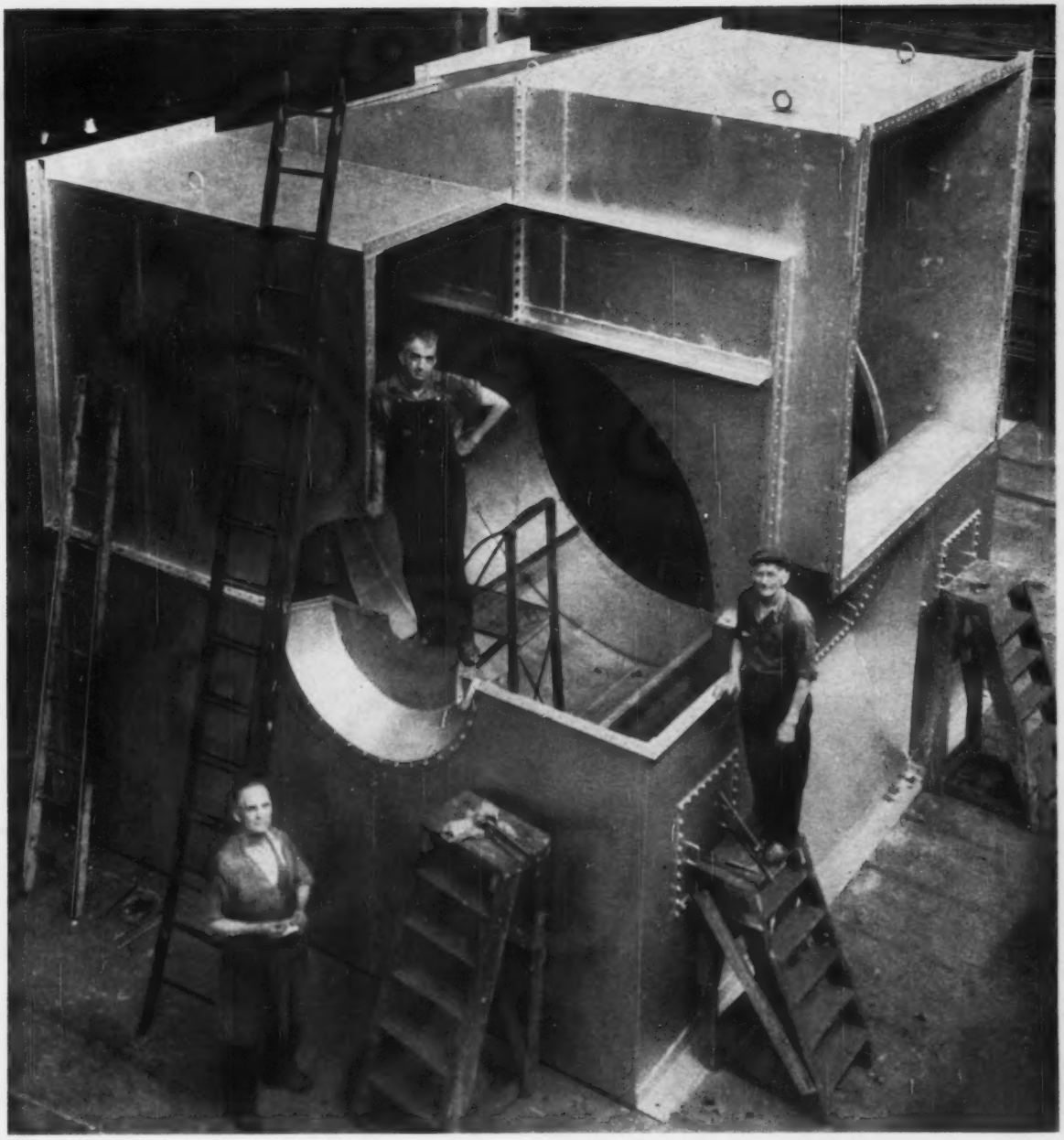
The budget manager gives budget advice to all other managers. He will help them set up a budget, then tell them if they are living within it or not. The procedures manager, on the other hand, publishes all company procedures and also assists any other manager in writing procedures for his department if help is asked. And the measurements manager assists all other managers in controlling their departments. He feeds them facts, analyzes their operations, compares them with others and interprets the comparisons. He helps any manager find where he stands, and where his department can go with improvements.

Ten years ago the comptroller wouldn't have been able to do that kind of job. Today, with Arizona's electronic data processing system, his job is possible. With EDP he can ferret out significant trends and gather up-to-the-minute performance facts that make his function a fact, not an ideal.

Will this organization change in the future? Changes are inevitable, the company says. "We do not anticipate that the structure of the company will ever remain constant for a great period of time," reports Keith Turley, manager of organization development services. The company's fast growth—plant investment has doubled since 1952—is partly responsible. And technical developments in the power business will account for great changes too. APS management is convinced that the utility business of the future will have little in common with the one we know today.

To chart the company's future path APS has set up a research and planning department to make long range studies of all its activities. Every manager in the company, of course, is responsible for innovating and planning. But most manager's plans are projected into the immediate future, based on the facts as they stand today. The research and planning department works perhaps 10-20 years ahead, searching out, planning, and aiming at future goals.

Arizona Public Service is as quick to credit outside ideas and companies for help in shaping its new organization as it is to assert that its scheme may not work for another utility. It realizes that the future of any company is limited only by the capacity and wisdom of its leaders. And it believes that its own organization, coupled with sound management, can bring out more of the potential of all its employees.



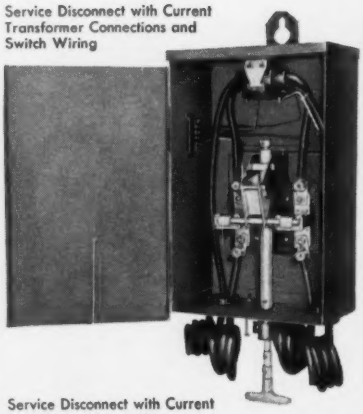
You wouldn't buy a bargain basement parachute... or a cut-rate big game rifle...

Don't choose less than Clarage quality for your mechanical draft service. With anything as vital as uninterrupted operation, it pays big dividends to get the best in equipment. Clarage, a specialist in building forced and induced draft fans, offers you equipment having a long-standing reputation for long-lasting service. CLARAGE FAN COMPANY, Kalamazoo, Michigan.

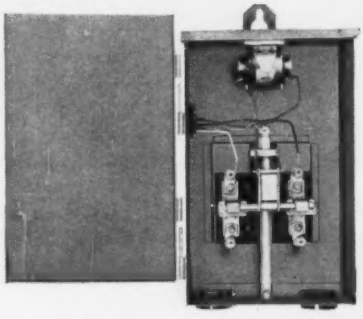
ANNOUNCING

Here's a new concept in farm safety . . . one main disconnect that lets your customers turn off electrical power at the maypole when they wish to . . . or when they have to . . . instantly, safely!

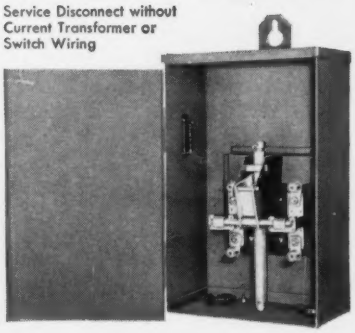
Service Disconnect with Current Transformer Connections and Switch Wiring



Service Disconnect with Current Transformer Connections



Service Disconnect without Current Transformer or Switch Wiring



BULLDOG'S NEW POLE-TOP MAIN SERVICE DISCONNECT

This new Pole-Top device sits securely at the top of the maypole eliminating the long, costly cable and heavy conduit runs necessary with ordinary eye-level pole switches. It's easily operated in a hurry, and padlocks "On" or "Off," as desired. The long control rod puts the handle at any convenient operating level. The Pole-Top switch is rain-tight and designed to take a metering transformer inside the switch-box.

Now your customers can have the safety and convenience of one main disconnect without the high installation costs of ordinary eye-level switches. The Pole-Top switch is UL listed as service equipment. For more information write:

BULLDOG ELECTRIC PRODUCTS DIVISION
I-T-E CIRCUIT BREAKER COMPANY
BOX 177 • DETROIT 32, MICHIGAN

In Canada: 80 Clayson Rd., Toronto 15, Ont. Export Division: 13 East 40th St., New York 16, N.Y.

Beebe, Walton Made Vice Presidents at UI

BEEBE

WALTON

Marshall F. Beebe and Edward H. Walton have been made vice presidents of United Illuminating Co.

Beebe has been general superintendent since 1950.

He started with UI 43 years ago, and served as field engineer, supervisor of overhead lines, superintendent of distribution in the New Haven Division, general superintendent of production, and superintendent of operations.

Joining UI in 1942 as a mechanical engineer, Walton then became assistant superintendent of production, assistant to the president, and assistant general superintendent.

Will Elected Chairman of VEPCO

Erwin H. Will has been elected chairman of the board and chief executive officer of Virginia Electric & Power Co. Donald C. Barnes, former chairman, becomes honorary chairman.

Will began his career with Vepco in 1922. He left the company in 1935 to accept a position with the El Paso Electric Co and rose to become its president. He returned to Vepco in 1947 as general manager of operations. In 1950 he was elected vice president and, in 1954, vice president and general manager.

He became a member of the board of directors in 1955 and was elected president in 1956. He was made chairman of the executive committee and vice chairman of the board of directors in April, 1958.

Barnes has been chairman and principal executive officer since 1947.

GE Reorganizes Apparatus and Industrial Group

General Electric Co has divided its Apparatus and Industrial Group into two components, an Industrial Group and an Electric Utility Group. Arthur F. Vinson, a vice president and formerly group executive of the Apparatus and Industrial Group, will be group executive of the Industrial Group. Clarence H. Linder, a vice president and formerly in charge of Engineering Services, is group executive for the Electric Utility Group.

The Industrial Group will be comprised of the Chemical and Metallurgical Division, Component Products Division, Motor and Generator Division, and the Apparatus Sales Division.

The Electric Utility Group will comprise the following: the Switchgear and Control Division, Transformer

VINSON

LINDER

(*Continued on page* 136)

"Chance Individually Packaged Clamps will give us better connections . . . automatically"

CC59-28

All Chance Hot Tap Clamps, Parallel Groove Clamps, Uniclamps, U-Bolt Clamps and Bail Clamps are available in individual plastic bags.

This observation is *typical* of the man responsible for line connections . . .

He knows that contact surfaces must be clean, and protected with an electrical contact aid to inhibit corrosion, maintain effective conductivity, prevent burndowns. He also knows how difficult it is to get linemen to take any extra steps when making a connection.

Chance Individually Packaged Clamps come to you in polyethylene bags with z.l.n. 100 Contact Aid factory-applied to the contact area. Linemen are spared those "extra steps"—they make better connections automatically. And, printed on the sealing tape of each package, there is a reminder to clean and coat the conductor. Supervision is simplified. Incidentally, linemen needn't remove their gloves to get at the clamp. They cut open the bag with sidecutters, and just slip it off the clamp.

When your crews use Chance Individually Packaged Clamps, you know a contact aid is being used on every connection, every time. Better, lasting connections are certain. z.l.n. 100 won't deteriorate . . . won't freeze, melt, run out, dry up, or wash away. Precoating protects when clamps are stored, too . . . ends the problem of in-stock contamination of contact surfaces.

So, standardize on Chance Individually Packaged Clamps, and get better connections . . . automatically.

A. B. CHANCE CO.

Centralia, Missouri

A. B. Chance Co. of Canada, Ltd., Toronto

NEW WHEELER·FULLERTON medium metal head

Utilities across the country have actually reduced head inventories AS MUCH AS 40% by stocking the unique new Wheeler-Fullerton medium head. It's made of die-cast aluminum and painted white on the inside for ease in maintenance and increased optical efficiency. *Look* at its application possibilities:

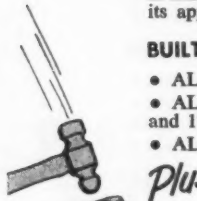
BUILT TO NEMA SPECIFICATIONS FOR

- ALL incandescent lamps and sockets!
- ALL mercury vapor lamps and transformers in 100W and 175W classes!
- ALL NEMA optical assemblies and reflectors!

Plus... **EXCLUSIVE KNOCKOUT* FEATURES!**

Wheeler-Fullerton exclusive KO features permit twist lock assembly for conversion to photoelectric head at any time. *No* special tools . . . *no* machining . . . and *no* jurisdictional problems!

**Pat. App. For*



FROM THIS TO THIS IN 2 MINUTES

Write for specifications and prices

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WHEELER-FULLERTON REPRESENTS THE MOST ADVANCED ENGINEERING IN STREET LIGHTING

GE Reorganizes Groups

(*Continued from page* 134)

Division and the Turbine Division.

The Apparatus Sales Division, a pooled marketing organization, will provide services for the Electric Utility Group, and will continue its services to the Electronic, Atomic and Defense Systems Group.

In another move, Hubert W. Gouldthorpe (see photo below) has been appointed general manager of the company's Switchgear and Control Division, Philadelphia He succeeds Lewis J. Burger who has been assigned to head up a newly established laboratory operation in Ft. Wayne, Ind., for the Component Products Division.

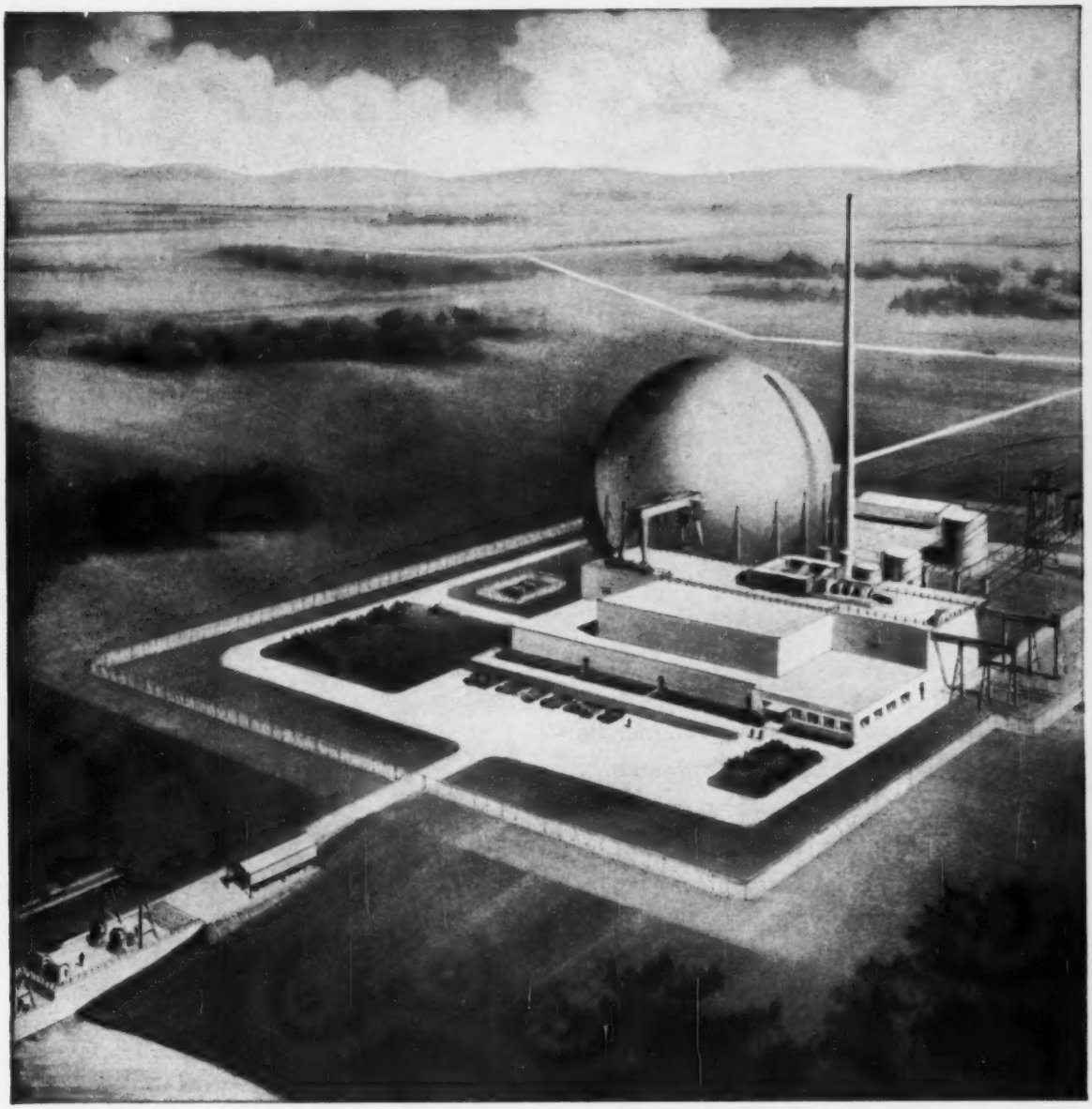
General Electric now has five product groups. In addition to the two new ones, there are the Consumer Products Group; the Electronic, Atomic, and Defense Systems Group; and the International Group.

Electrical World Makes Editorial Staff Changes

In its continuing effort to improve service to readers, Electrical World has announced organization and staff changes designed to provide additional depth of coverage and flexibility in assignment.

Management of the editorial operation of the publication has been assigned to Herbert R. Frankel, who will carry the new title of

(*Continued on page* 138)



Concept of a 306 MW boiling water nuclear power plant, the result of a design study for the U. S. Atomic Energy Commission, symbolizes Ebasco's competence in nuclear engineering and the company's 54-year reputation for outstanding quality in diversified engineering and construction work.

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For the last 30 years, Electromode people have vigorously promoted electric heating. The merchandising concepts necessary to successful promotion of electric heat to residential, farm and industrial markets are not strange to us. We make, sell, install and service every practical type of resistance heating equipment for these markets. When it is time to launch a vigorous electric heating promotion in your area, we invite you to discuss your problems and plans with us. We would be glad to help. We are confident that we can.

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Dept. EW-10, Division of Commercial Controls Corporation, Rochester 3, New York

EW Makes Staff Changes

(*Continued from page* 136)

managing editor, and report to the chief editor.

Frankel, who has been with Electrical World since 1951, has been associated with the electrical utility industry for over 30 years, specializing in financial, regulation, labor and public relations matters. Most recently, he has been managing news editor.

Responsibility for coverage of the subjects handled by Electrical World has been assigned to Daniel T. Braymer, Leonard M. Olmsted and Jesse A. Mock, as senior editors. They will report directly to the chief editor.

Braymer has been with Electrical World since 1935, specializing in

FRANKEL BRAYMER

OLMSTED MOCK

generation, transmission and system engineering. He has held the title of senior editor since last year.

Olmsted joined Electrical World in 1952 after 18 years with Duquesne Light Co. His specialization has been distribution engineering. Most recently, he was managing technical editor.

Mock, with the staff since 1954, also has served with the McGraw-Hill Washington News Bureau. Besides serving recently as EW manager of production, he has specialized in manufacturers' activities.

T. R. Jordan, assistant managing news editor, has been named associate editor in charge of the news operation. He joined the magazine in 1956.

NOMINAL WEIGHTS OF FINISHED WEATHER-RESISTANT WIRE AND CABLE

(Pounds per 1000 Feet)

Conductor Size AWG or Mcm	Copper & Copper Alloy Conductors: URC Type Double Braid	URC Type Triple Braid	Neoprene Type	Polyethylene Type	Aluminum Conductors: Neoprene Type	Polyethylene Type
Stranded						
2	246	270	248	**230**	105	**87.4**
4	155	170	163	**143**	73.3	**53.3**
6	103	115	108	**91.5**	51.5	**35.0**
Solid						
2	239	260	232	**219**	92.2	**79.2**
4	151	164	152	**136**	64.0	**48.0**
6	100	112	101	**87**	45.7	**31.7**

Sources: American Standards Association Specifications

This table shows

POLYETHYLENE covered line wire weighs less

Because it's the lightest, polyethylene-covered line wire is the easiest for linemen to string up . . . hardest for ice and snow loading, gale-force winds to bring down.

Polyethylene-covered line wire, depending on size and conductor, weighs from 5% to 32% less than other types. That's what the figures in the specifications tabulated above show.

This, of course, is no news to linemen who have strung all types of weatherproof line wire. They may not be able to quote pounds and percentages, but they all know you can't beat polyethylene on weight.

Linemen's Favorite Material

Light weight means easy handling, one of the main reasons polyethylene rates tops with installation crews. They also like polyethylene wire because it's clean... free-stripping... has a smooth, self-lubricating surface that almost makes pulling a pleasure. And despite the exterior slip, the plastic covering hugs the conductor tightly, doesn't ruffle as it goes over crossarms.

"Built-in" Safety Factor

Polyethylene's lightness provides lasting mechanical advantages, since span loads don't tax supports as much as heavier type wire. This "built-in" weight safety factor pays off when violent storms push aerial construction to strain limits... when ice and snow loads topple heavier lines.

An added factor in polyethylene wire's ability to stay up under adverse conditions is its smaller diameter. It offers less resistance to wind, a smaller surface for ice build-up.

Winning Combination

Called the "closest to the ideal covering for line wire," polyethylene is outstanding in other respects too. The shield it forms over wire is continuous... tough... resistant to aging, weathering, moisture, abrasion by lashing branches. It's good for decades of superior service marked by fewer outages, minimum maintenance.

When you order covered wire and cable, make sure the coating is made with PETROTHENE® polyethylene resins. PETROTHENE polyethylene costs no more, but it gives you premium weather and stress-crack resistance.

Polyethylene's advantages are outlined in an informative new U.S.I. data sheet, "Polyethylene... The Best Line Wire Covering." Also available is a data sheet showing properties, applications and specifications of PETROTHENE polyethylene compounds. Send for your copies today.

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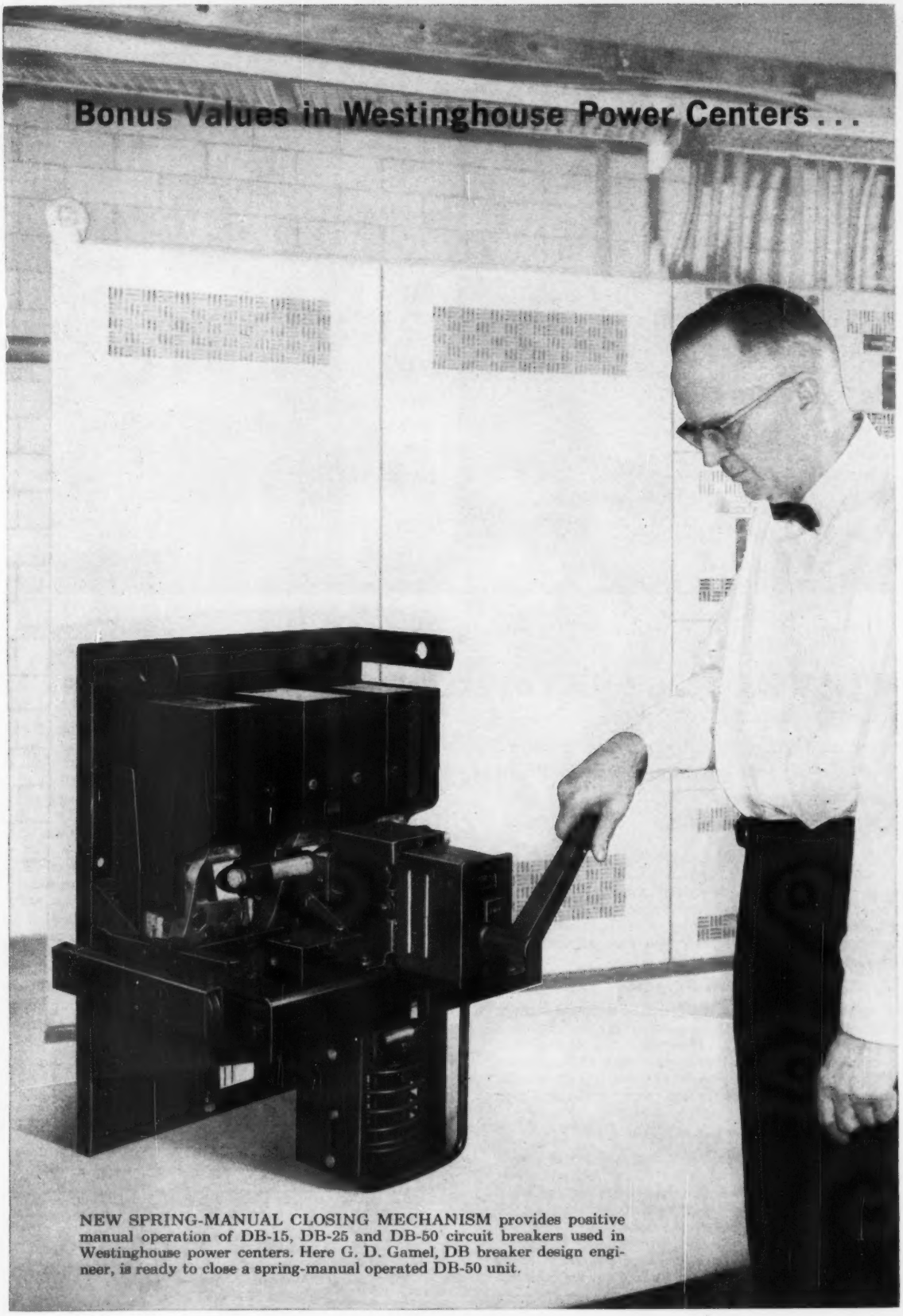

NEW SPRING-MANUAL CLOSING MECHANISM provides positive manual operation of DB-15, DB-25 and DB-50 circuit breakers used in Westinghouse power centers. Here G. D. Gamel, DB breaker design engineer, is ready to close a spring-manual operated DB-50 unit.

Westinghouse power centers offer greatest component selection . . . plus new switchgear insulation

You Can Choose the Breaker Operation You Need. Low-voltage air circuit breakers (DB-15, DB-25 and DB-50) provided in Westinghouse power centers are now available with a choice of manual, spring-manual or electric closing mechanisms. In accordance with industry standards, DB-75 and DB-100 breakers are available with an electrically operated closing mechanism only.

You Can Choose the Transformer You Need. As with breaker closing mechanisms above, Westinghouse gives you complete freedom of choice in selecting the power center transformer best suited to your application. Within code limitations, you can choose *oil-filled* for outdoor service . . . *Inerteen®-filled* for outdoor or indoor service where a nonflammable, liquid-cooled transformer is desirable . . . *ventilated dry-type* for maximum safety and minimum maintenance under controlled atmospheric conditions, indoors . . . and *sealed dry-type* for complete safety and virtually no maintenance, under adverse atmospheric conditions, indoors or outdoors. All dry-type transformers are equipped with low-ratio RM lightning arresters.

New Westinghouse Insulation of improved glass polyester material is used for bus supports and short circuit bracing in Westinghouse low-voltage metal-enclosed switchgear. In addition to being highly track resistant, this new insulation is also flame retardant, and the design of supports and bracing provides increased vertical creepage distances. Result is maximum safety with minimum maintenance.

These features are only a few of the continuing product improvements that provide true bonus values beyond specification in Westinghouse power centers. For complete details, call your Westinghouse representative—or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. J-60979-R

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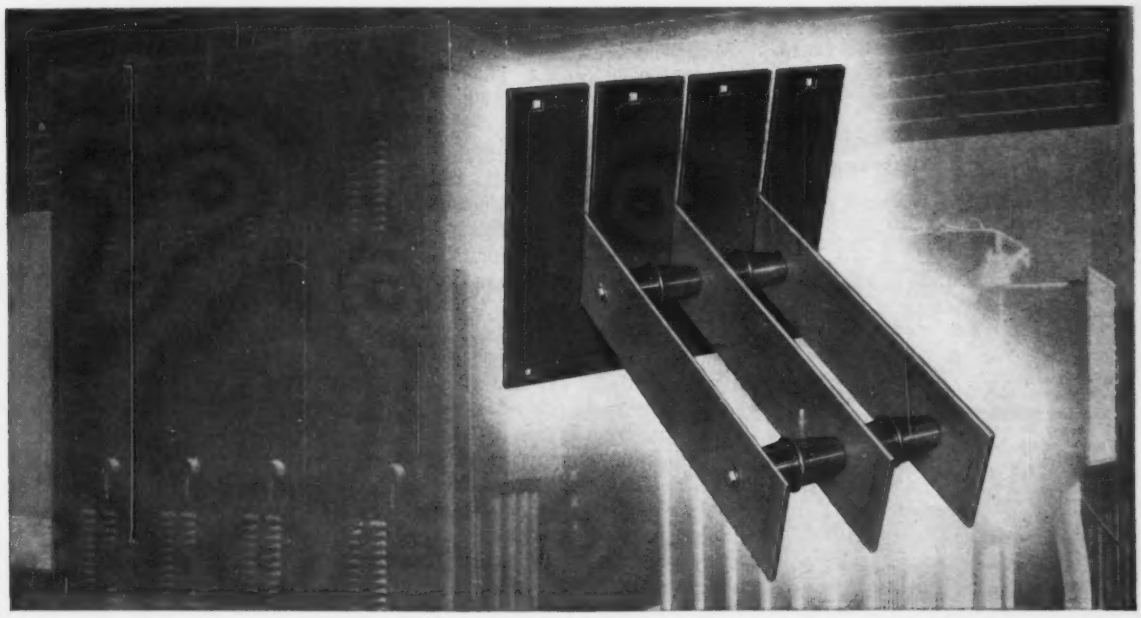

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Design the Molecule

(*Continued from page* 68)

be limited at normal ambients even when new. The reason for this limitation is that there is no existing cable insulation with adequately and permanently low dielectric loss. It is now feasible for high polymer chemists to tailor the molecule for a specific use such as 500 kv insulation according to such authorities as Dr. Herman Mark of Brooklyn Polytechnic Institute.

However, the volume of material required would be small unless it should happen that the new resin is useful in the mass-market low-voltage cable field. If 350 to 500-kv cable with desirable and permanent characteristics is wanted, the job of developing insulating materials will have to be undertaken specifically for 500 kv.

The industry needs to train more insulation chemists and physicists to help guide the development of new materials specific to each application. A number of secondary insulation problems could be studied after the new insulation research got underway.

Bullock Bullish on Utilities' Resistance to Inflation

The electric utility industry "would seem to be in a position to counter future inflationary forces, if they do not become greater than those of recent years." This is the view of the Calvin Bullock investment firm.

In the November issue of *Perspective*, published by Bullock's investment management department, the New York firm notes that wages and salaries now account for 17.7% of total revenues compared with 21.9% of 1949.

Technological improvements have seen fuel costs per revenue dollar drop from 20¢ in 1948 to 16¢ last year. In the same period operating income rose from 20.3% to 21.9%, the publication states.

"These results should dispel the mistaken impression so often expressed that utility companies are unduly vulnerable to inflation," the article declares.

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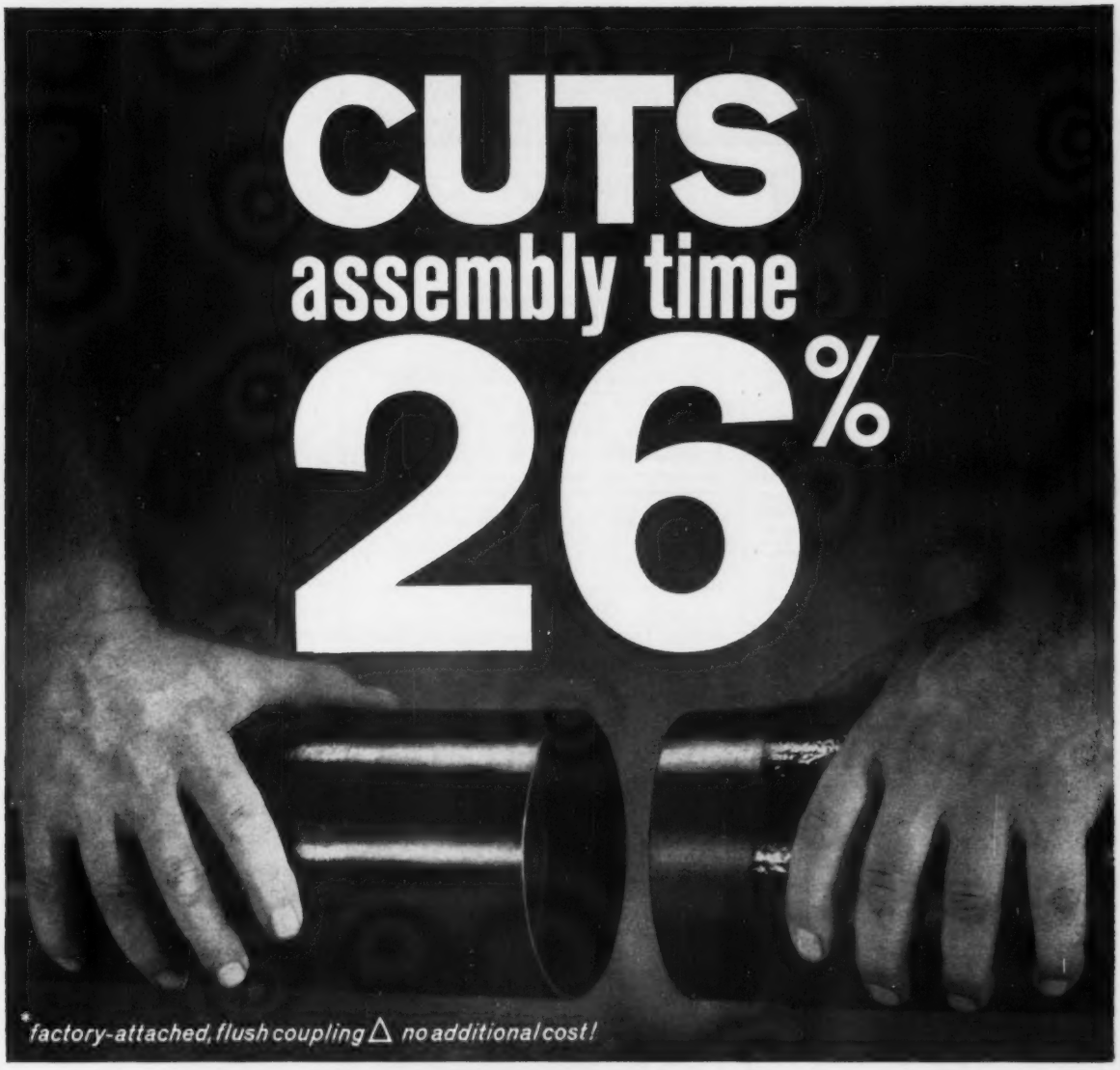

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With no separate couplings to handle or attach on the job, Orangeburg CA lays faster, costs less to install. Each long, light length has a *flush* coupling attached at one end and a standard 2° male taper at the other end, making installation a simple, one-step operation. And, since the coupling *is* attached, there are no coupling cartons to warehouse or carry to the job.

What's more, with the coupling *flush* to the conduit's outside wall, new CA is easy to stack, store and handle. The flush coupling also eliminates "staggered" joints in the trench. And that means real savings in cutting and tooling time.

Like the hundreds of millions of feet of Orangeburg fibre conduit in use since 1893, new CA has self-sealing joints and impermeable walls. Its smooth, 100% fibre raceway adds years to cable life.

New Orangeburg CA is available in 2", 3", 3½", 4", 4½" and 5" sizes. Orangeburg Standard and Nocrete Conduit, with separate sleeve couplings, are available as always. Write Dept. EW-10 for Catalog 52.

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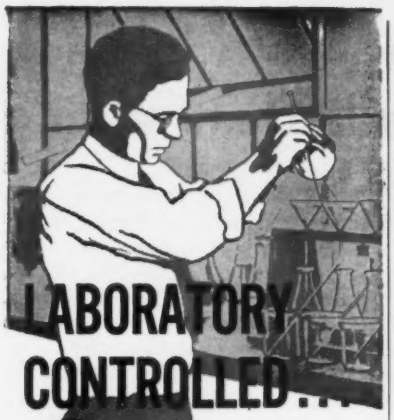

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Heavy, uniform, tightly-bonded zinc coatings, applied by the famous Crapo Galvanizing Process, provide maximum resistance to corrosion.

Write for booklet OG-25 containing "Sag and Tension Data for Overhead Ground Wire."

INDIANA

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Tampa Cites Safety Record, Other Systems Note Gains

There were no cold cuts in the dinner for Peter O. Knight generating station employees when they were honored recently for working over 2-million man-hours without a disabling injury. The dinner and an award ceremony took place in the boiler room of the Tampa Electric Co plant, where the steaks were charcoal broiled on the floor.

William C. MacInnes, right above, the utility's president, made the accident prevention award to Norman M. Johnson, the plant's chief engineer. The accident-free period covered over 11 years.

Georgia Power Co racked up one of its best safety records last year, John J. McDonough, president, announced last fortnight. The 5,400 employees worked more than 10.5-million man-hours with only 15 lost-time accidents. There were no fatalities during the year.

The performance includes an unblemished 2-million consecutive man-hours and another period of 1-million man-hours. The record qualifies Georgia Power for Edison Electric Institute awards, which will be presented this year.

The more than 600 employees of Chattanooga Electric Power Board will again be eligible for a safety bonus this year. Starting Jan. 1, each employee began building a fund that could total $15 by Dec. 15, 1960 if no employees suffer lost-time accidents.

The bonus kitty starts at $8,250. For each lost-time injury $500 is deducted from the total, or $1 from each employee's share. In the previous program ending in June, 1959, each worker got $8.

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Fish Facility Adequacy StressedatDamHearing

In nearly every Pacific Northwest hydro project proposal fish are the main problem. The Pacific Northwest Power Co's $245-million High Mountain Sheep dam is no exception, as hearings before the Oregon Water Resources Board confirmed earlier this month. Testimony for PNPC maintained the 690-ft high dam will have adequate fish facilities to sustain salmon and steelhead runs in the Snake and Imnaha rivers. The dam's site would preclude building the Nez Perce project. Nez Perce would dam not only the Snake and Imnaha but also the Salmon River—spawning bed for 30% of Columbia River salmon vs 3% of Imnaha. Milo Bell, a top fish facility authority, and Dr J. A. R. Hamilton, Pacific Power & Light Co fisheries biologist, were among experts who backed the PNPC view. Intervenors said that no more dams should be built on the Snake because they are depleting fish runs. The Northwest Public Power Association has been authorized to intervene despite the charge by PNPC that the group was "bringing in issues completely irrelevant to the proceedings." One PNPC spokesman said a 10-yr delay of High Mountain Sheep would cause an economic loss of $188 million. The estimate was made by A. E. Alspaugh of Pacific Power & Light Co, one of the four utilities making up PNPC.

FACILITY FEATURES are explained by Frank Warren Jr, left, head of Portland GE, to Dr Karl Onthank of OWRB

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The Importance of Balanced Compounding in Portable Cable Design

A portable cable is constantly under attack from many different directions. It is dragged over rough floor surfaces and rocky terrain, crushed under the wheels of trucks and carts, continually bent, flexed and stretched. In addition, it is very often subjected to attack by water, solvents, oil and ozone.

To give long, dependable service, portable cables must be able to withstand rough treatment, and must have built-in protection against all deteriorating factors. Moreover, they must possess other desirable qualities such as lightness and flexibility.

The science in designing these cables is to add the necessary ingredients in the jacket to provide maximum protection along with the maximum of other desirable features. This is where *Balanced Compounding* comes in. It is very easy to provide protection against one or two of the deteriorating factors, simply by loading the compound with an ingredient which is impervious or highly resistant to these factors. Unfortunately, however, the ingredients which provide resistance to abrasion or crushing may be highly susceptible to attack by oil or water; and vice versa.

The cable designer's problem, then, is to attain a balance in his compounding formula which will provide maximum protection against one deteriorating factor without reducing protection against others below the danger point.

To the buyer of cables, this means that *quantity* of any one ingredient is unimportant, unless it is considered in relation to the over-all ability of the cable jacket to resist *all* of the abuses to which it is subjected.

For balanced resistance to all these abuses, the best assurance you can get lies in the quality of the research and development facilities of the manufacturer, and the product's record of performance.

This is one reason why — in those industries where portable cables are continually used or purchased as components of a manufactured product — Simplex Tirex Cables are regarded as the standard.

Proof of the worth of Tirex *Balanced Compounding*, which gives balanced resistance to all the deteriorating factors of normal use, can be found in the fact that Tirex cables have been successfully performing under the most rugged operating conditions for periods ranging up to twenty years.

BALANCED COMPOUNDING CURED IN LEAD

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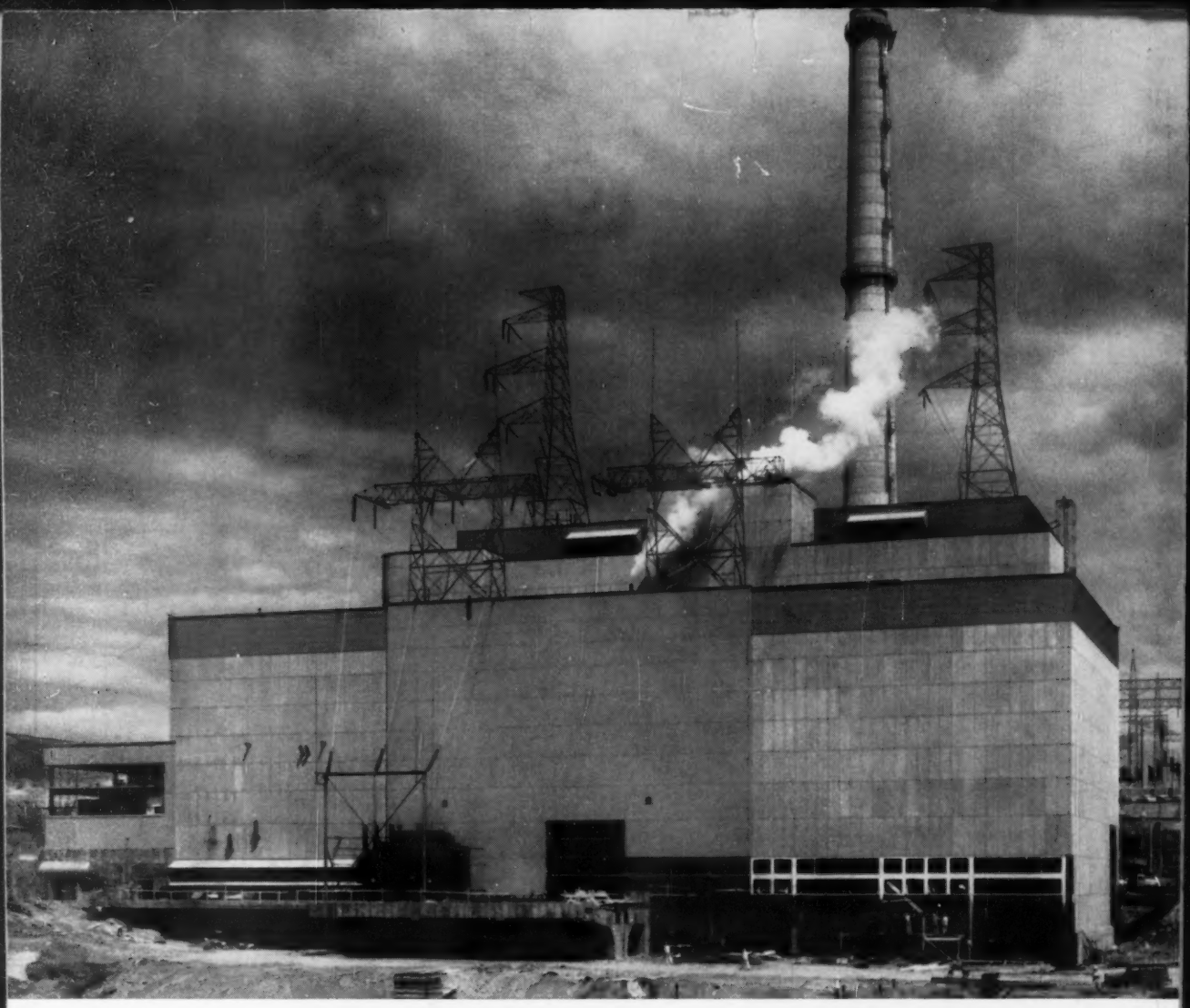

PEPCO DICKERSON #1 ON THE LINE: UNIT #2 COMING SOON

Unit #1 of the new Dickerson Station of Potomac Electric Power Company went on the line in June 1959. A second duplicate unit is scheduled for service in early 1960. This modern station was designed and constructed by Stone & Webster Engineering Corporation in conjunction with the Engineering Departments of PEPCO. Major fluid handling equipment furnished by Worthington includes the condensers, circulating water and condensate pumps, rotative dry vacuum pumps, boiler feed and booster pumps, and main deaerators to supplement condenser deaeration in protecting the boilers and feed cycle.

The fluid handling equipment for each unit incorporates a number of special features. Included is the power-saving technique of a single full capacity boiler feed pump driven from the main turbine generator shaft through a variable speed coupling, with a spare turbine driven feed pump. Use of booster pumps also permitted mounting the main deaerator on the turbine room floor, thus minimizing cost of supporting structure and piping.

The condenser serving each unit is 110,000 sq. ft. two-pass, of special construction for maximum deaeration. It is rigidly mounted with rubber belt-type expansion joint in the turbine exhaust connection, and equipped with built-in reverse flow valves for periodic backwashing. The separate screenhouse at the river contains four circulating water pumps of vertical single suction volute MIXFLO dry pit type, driven by two-speed induction motors, supplying 95,000 gpm to each unit.

As a manufacturer of major steam cycle fluid handling equipment, Worthington has a reservoir of "system-wise" experience available to help in your power planning projects. For information, call your nearest Worthington District Office. Or, write to Worthington Corporation, Section 45-15, Harrison, New Jersey.

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